MITSUBISHI

PROGRAMMABLE CONTROLLER

MELSEC-A

Programming Manual

type A2A(S1)/A3ACPU(AD57 Instructions)

MITSUBISHI ELECTRIC

REVISIONS

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INTRODUCTION

Thank you for choosing the Mitsubishi MELSEC-A Series of General Purpose Programmable Controllers. Please read this manual carefully so that the equipment is used to its optimum. A copy of this manual should be forwarded to the end User.

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1. INTRODUCTION

This manual describes sequence program instructions used to control the AD57(S1)/AD58 CRT/LCD controllers with an A2ACPU(S1) or A3ACPU.

Because the A2ACPU(S1) and A3ACPU support the instructions to be used for the AD57(S1)/AD58 as standard instructions, these CPUs can use the AD57(S1)/AD58 without merging microcomputer program packages for the AD57.

POINT

(1) An AD57S2 monitor display controller cannot be used with an A2ACPU(S1)/A3ACPU.
(2) To control an AD57(S1)/AD58, create the canvas ROM and character generator ROM using the SW1GP-AD57P system floppy disk and install them in the AD57(S1)/AD58.
For the procedure to create a canvas ROM and character generator ROM, refer to the SW1GP-AD57P Operating Manual.

When controlling the AD57(S1)/AD58, use character string processing instructions described in the A2A(S1)/A3ACPU Programming Manual (Dedicated Instructions). This allows displaying of data on the screen, reading/storing the displayed data, and other similar operations to be performed easily.

For the instructions not described in this manual, refer to the following manuals.

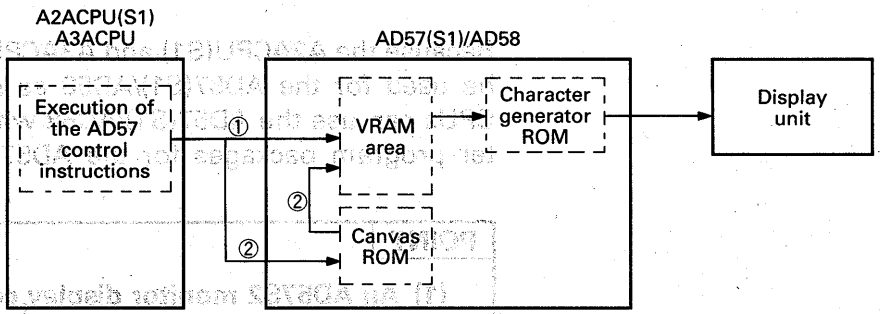
ACPU Programming Manual (Fundamentals) [IB(NA)-66249]
ACPU Programming Manual (Common Instructions) [IB(NA)-66250]
A2A(S1)/A3ACPU Programming Manual (PID Control Instructions) [IB(NA)-66258]

Refer to the following manuals when using the A2ACPU(S1)/A3ACPU.

A2ACPU(S1)/A3ACPU User's Manual (Hardware) [IB(NA)-66255]
A2ACPU(S1)/A3ACPU User's Manual (Control Functions) [IB(NA)-66256]
SW4GP-GPPA Operating Manual [IB(NA)-66259]

1.1 Displaying Characters

How characters are displayed on the display unit connected to the AD57(S1)/AD58.



By writing the characters to be displayed to the AD57(S1)/AD58 VRAM area, these characters are displayed automatically on the display unit.

To display characters on the display unit connected to the AD57(S1)/AD58 using an A2ACPU(S1)/A3ACPU, use the AD57 control instructions.

By executing the AD57 control instructions, designate data is written to the VRAM area of AD57(S1)/AD58. (① in the above illustration)

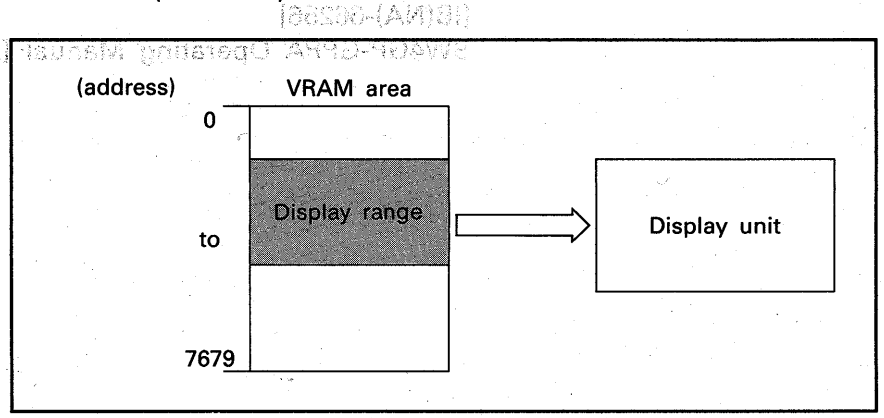
To display the screen data stored in the canvas ROM, designated the number of the screen to be displayed. The designated canvas screen data is automatically read from the canvas ROM and written to the VRAM area. (② in the above illustration)

1.1.1 VRAM area configuration

The VRAM area consists of the area of addresses 0 to 7679, where the screen data of 7680 words can be stored.

On the screen, the following amount of data among 7680 words is displayed in one display page.

Standard display mode of CRT (for AD57(S1)) ····· 1600 words
Enlarged display mode of CRT (for AD57) ····· 400 words
LCD mode (for AD58) ····· 800 words



(1) The screen display data stored in the VRAM area is as indicated below. By changing the area to be displayed, the stored data is displayed according to the designated display range.

	AD57		AD58
	AD57-S1		
	Standard display mode	Enlarged display mode	
0	Display data 1	Display data 1	Display data 1
400		Display data 2	
800		Display data 3	Display data 2
1200		Display data 4	
1600	Display data 2	Display data 5	Display data 3
2000		Display data 6	
2400		Display data 7	Display data 4
2800		Display data 8	
3200	Display data 3	Display data 9	Display data 5
3600		Display data 10	
4000		Display data 11	Display data 6
4400		Display data 12	
4800	Display data 4	Display data 13	Display data 7
5200		Display data 14	
5600		Display data 15	Display data 8
6000		Display data 16	
6400	(Vacant)	Display data 17	Display data 9
6800		Display data 18	
7200		Display data 19	(Vacant)
7600		(Vacant)	
7679			

(a) In the "vacant" areas shown above, it is not possible to store the data to be displayed. However, users can use these areas.

(b) To store the display data in the VRAM area, use the AD57 control instructions such as the CPS1 and CMOV instructions.

(c) Use the CPS2 instruction (AD57 control instruction) to select the area to be displayed. The display areas can be changed in units of addresses
The head address of the area to be displayed is called the VRAM display head address.

(d) When the AD57 is used, standard mode display data and enlarged mode display data can be stored at random in the VRAM area as illustrated below.

VRAM area	
0	Enlarged mode display data
399	
400	Standard mode display data
1999	
2000	Standard mode display data
3599	
3600	Enlarged mode display data

(2) Correspondence between the VRAM area addresses and the display position in the display unit is shown below.
At VRAM area addresses, character codes of the characters to be displayed are stored.

(A: The head address of the VRAM area displayed in the display unit)

Standard mode

Line \ Column	0	1	2	~	77	78	79
0	A+0	A+1	A+2		A+77	A+78	A+79
1	A+80	A+81	A+82		A+157	A+158	A+159
2	A+160	A+161	A+162		A+237	A+238	A+239
⟆							
18	A+1440	A+1441	A+1442		A+1517	A+1518	A+1519
19	A+1520	A+1521	A+1522		A+1597	A+1598	A+1599

Enlarged mode

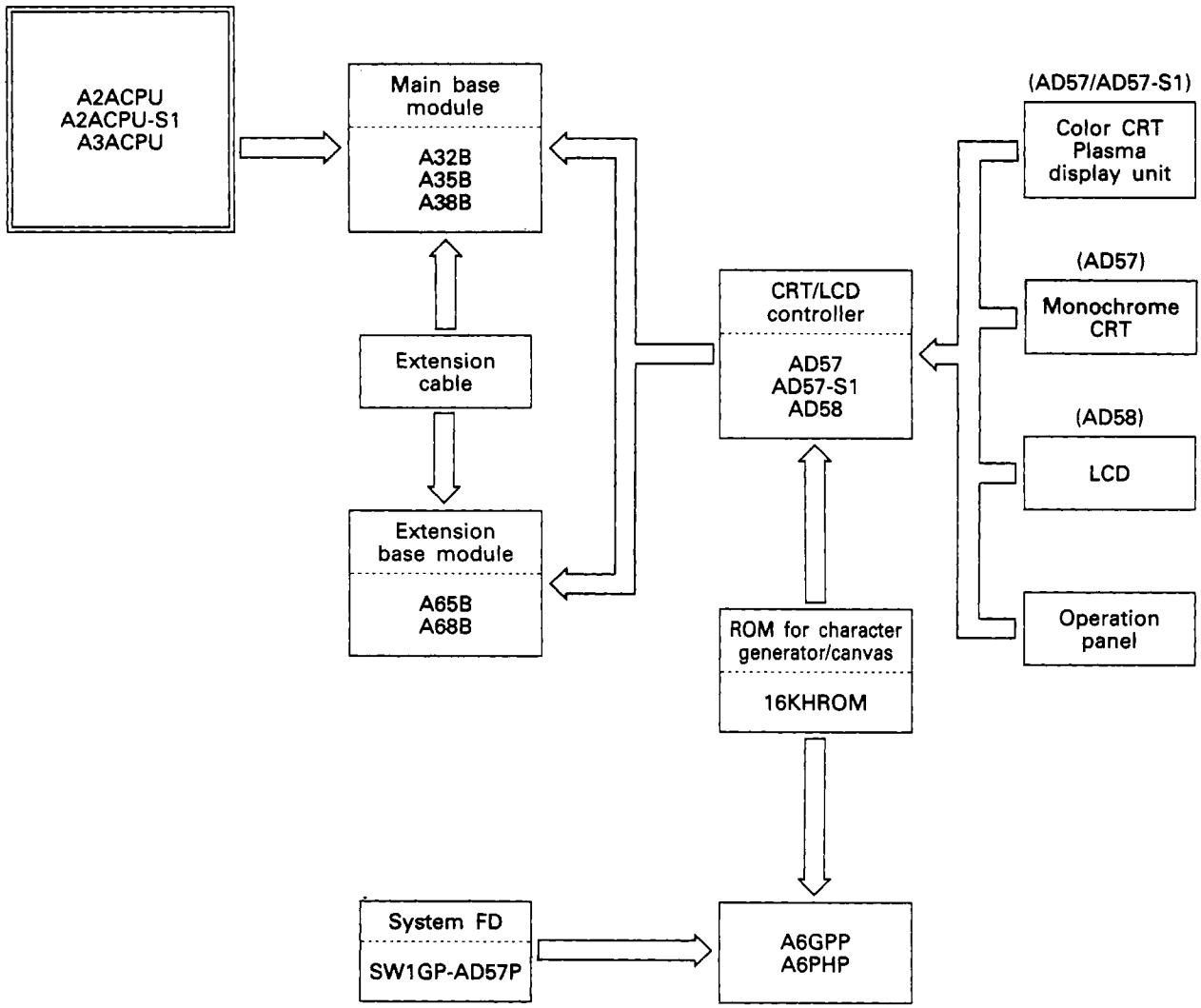
Line \ Column	0	1	2	~	37	38	39
0	A+0	A+1	A+2		A+37	A+38	A+39
1	A+40	A+41	A+42		A+77	A+78	A+79
2	A+80	A+81	A+82		A+117	A+118	A+119
⟆							
8	A+320	A+321	A+322		A+357	A+358	A+359
9	A+360	A+361	A+362		A+397	A+398	A+399

LCD mode

Line \ Column	0	1	2	~	77	78	79
0	A+0	A+1	A+2		A+77	A+78	A+79
1	A+80	A+81	A+82		A+157	A+158	A+159
2	A+160	A+161	A+162		A+237	A+238	A+239
⟆							
8	A+640	A+641	A+642		A+717	A+718	A+719
9	A+720	A+721	A+722		A+797	A+798	A+799

2. SYSTEM CONFIGURATION FOR CONTROLLING AD57(S1)/AD58

This chapter describes the configuration of the system used to control the AD57(S1)/AD58 with the A2ACPU(S1)/A3ACPU.



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(1) The number of AD57(S1)/AD58 modules that can be used with one A2ACPU(S1)/A3ACPU varies depending on the number of the following modules.

- AD59(S1)
- AJ71C24(S3)
- AJ71C21(S1)
- AJ71PT32(S3)

Use the following formula to calculate the number of usable AD57(S1)/AD58.

$$\text{Usable AD57(S1)/AD58} = \frac{1344 - (5 \times (\text{Used number of AD59(S1)}) + 10 \times (\text{Loaded number of AJ71C24(S3)}) + 29 \times (\text{Loaded number of AJ71C21(S1)}) + 125 \times (\text{Loaded number of AJ71PT32(S3)}))}{8} \text{ [units]}$$

Example: Assume that the following number of devices is used.

AD59 ····· 3 units
AJ71C24-S3 ····· 5 units
AJ71PT32-S3 ····· 2 units

$$\text{The number of usable AD57(S1)/AD58} = \frac{1344 - (5 \times 3 + 10 \times 5 + 29 \times 0 + 125 \times 2)}{8}$$

$$= 56.625 \cdots\cdots 56 \text{ units}$$

Although the above indicated number is obtained as the result of calculation, actual number of loadable AD57(S1)/AD58 is limited to the following number due to the I/O number of the PC Pus.

A2ACPU ····· 8 units
A2ACPU-S1 ····· 16 units
A3ACPU ····· 32 units

(2) To control AD57(S1)/AD58, create the canvas ROM and character generator ROM using the SW1GP-AD57P system FD and install these Ross in AD57(S1)/AD58. For the procedure to create the canvas ROM and character generator ROM, refer to the SW1GP-AD57P Operating Manual.

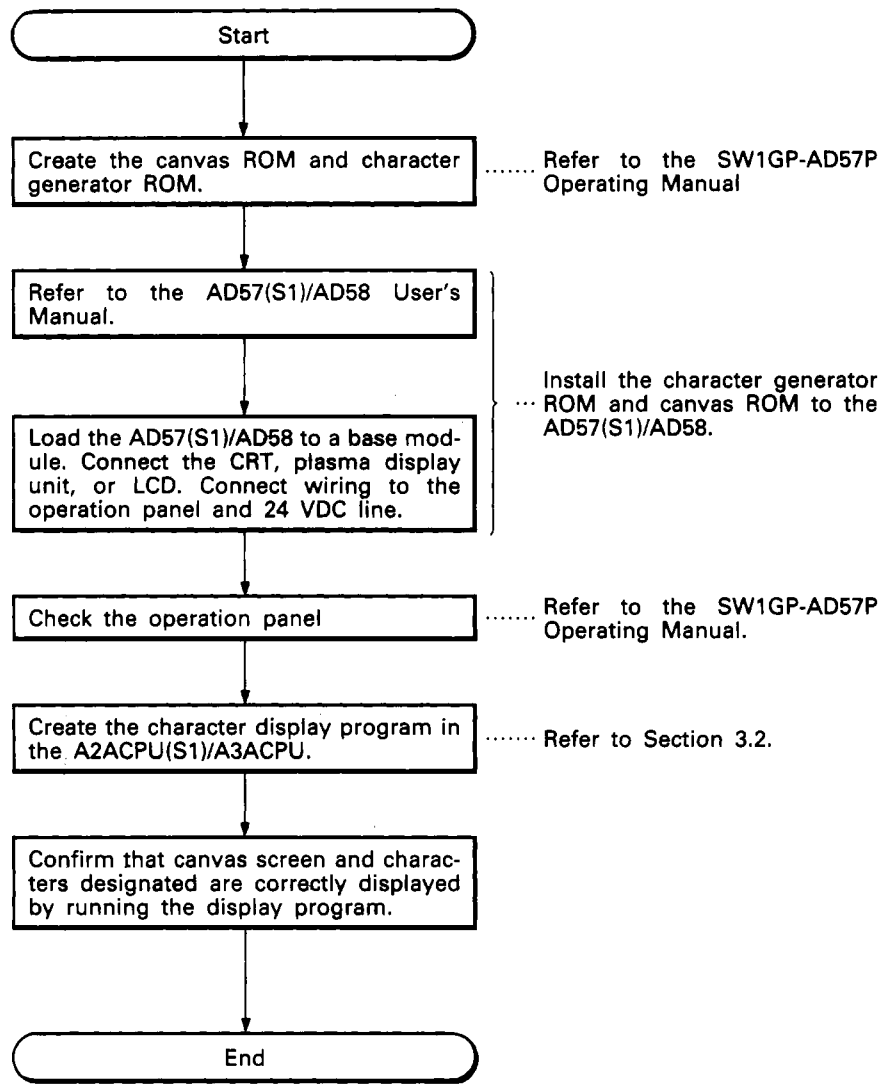
(3) An extension base module cannot be connected to an A32B main base module.

3. PROGRAMMING PROCEDURE

This chapter describes the setting and programming procedure to display characters in the display unit connected to the AD57(S1)/ AD58.

3.1 Displaying Procedure

This section describes the procedure to display characters on the display unit.


Start
Create the canvas ROM and character generator ROM.
..... Refer to the SW1GP-AD57P Operating Manual
Refer to the AD57(S1)/AD58 User's Manual.
Load the AD57(S1)/AD58 to a base module. Connect the CRT, plasma display unit, or LCD. Connect wiring to the operation panel and 24 VDC line.
··· Install the character generator ROM and canvas ROM to the AD57(S1)/AD58.
Check the operation panel
..... Refer to the SW1GP-AD57P Operating Manual.
Create the character display program in the A2ACPU(S1)/A3ACPU.
..... Refer to Section 3.2.
Confirm that canvas screen and characters designated are correctly displayed by running the display program.
End

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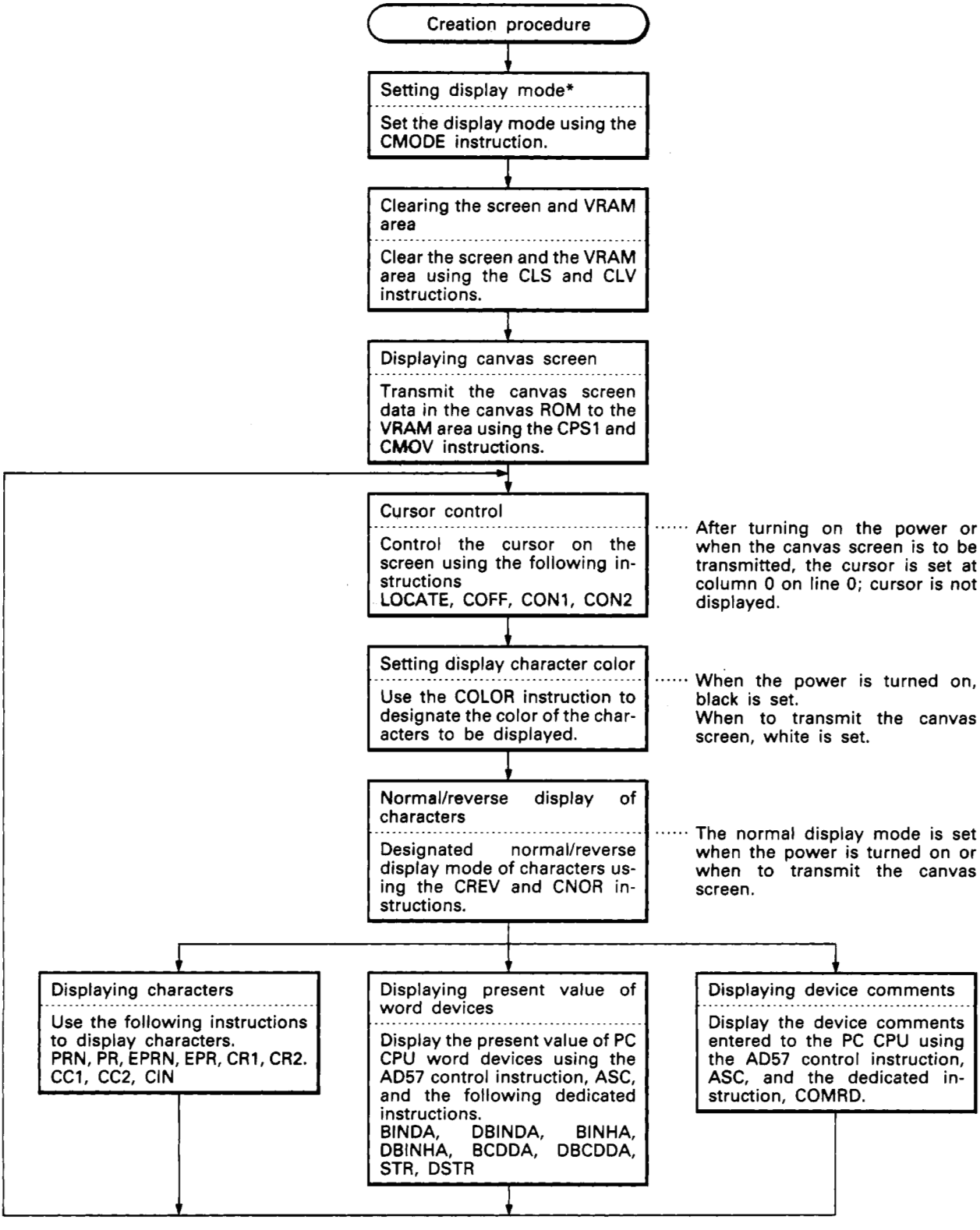
3.2 Programming Procedure

This section describes the procedure to create the program to display the canvas screen and the characters on the display unit connected to the AD57(S1)/AD58 using the AD57 control instructions.


Creation procedure
Setting display mode*
Set the display mode using the CMODE instruction.
Clearing the screen and VRAM area
Clear the screen and the VRAM area using the CLS and CLV instructions.
Displaying canvas screen
Transmit the canvas screen data in the canvas ROM to the VRAM area using the CPS1 and CMOV instructions.
Cursor control
Control the cursor on the screen using the following instructions
LOCATE, COFF, CON1, CON2
After turning on the power or when the canvas screen is to be transmitted, the cursor is set at column 0 on line 0; cursor is not displayed.
Setting display character color
Use the COLOR instruction to designate the color of the characters to be displayed.
When the power is turned on, black is set.
When to transmit the canvas screen, white is set.
Normal/reverse display of characters
Designated normal/reverse display mode of characters using the CREV and CNOR instructions.
The normal display mode is set when the power is turned on or when to transmit the canvas screen.
Displaying characters
Use the following instructions to display characters.
PRN, PR, EPRN, EPR, CR1, CR2. CC1, CC2, CIN
Displaying present value of word devices
Display the present value of PC CPU word devices using the AD57 control instruction, ASC, and the following dedicated instructions.
BINDA, DBINDA, BINHA, DBINHA, BCDDA, DBCDDA, STR, DSTR
Displaying device comments
Display the device comments entered to the PC CPU using the AD57 control instruction, ASC, and the dedicated instruction, COMRD.

* When module name entry is executed in parameter setting, it is not necessary to set the display mode with the CMODE instruction.
The following mode is automatically set when the PC CPU state is changed from STOP to RUN.

AD57 entered ····· "0" is set
AD57-S1 entered ····· "5" is set
AD58 entered ····· "2" is set

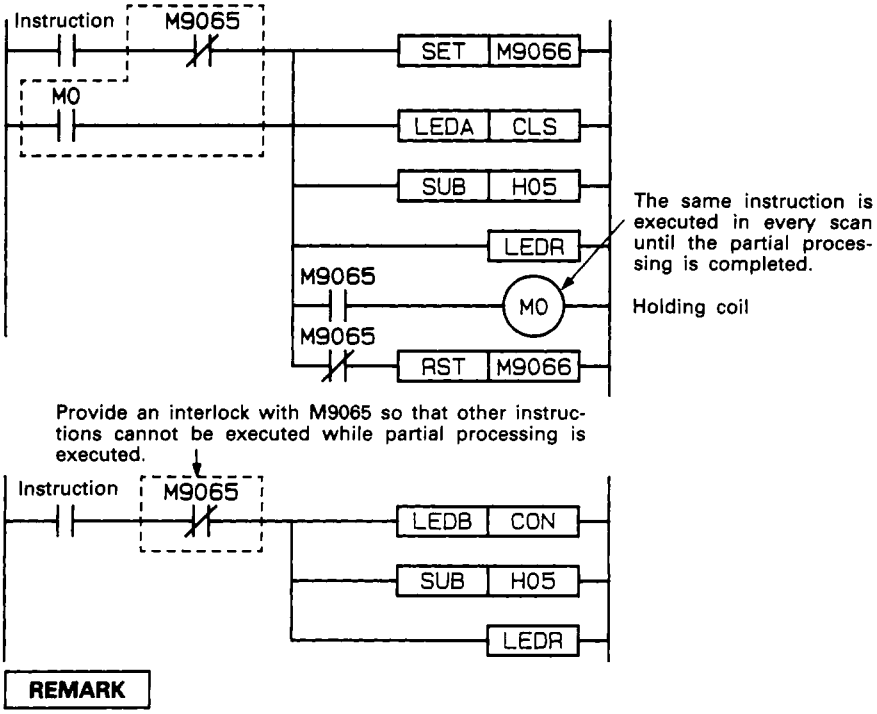
For details of module name entry procedure, refer to the SW4GP-GPPA Operating Manual.

3.3 Cautions on Writing Programs

(1) Always set the display mode using the CMODE instruction when the PC power is turned on, the PC CPU is reset, or when the PC CPU RUN/STOP switch position is changed from STOP to RUN.
The display unit will fail to give correct display if the display mode is not set or correct display mode is not set.
However, when module name entry is executed in parameter setting, it is not necessary to set the display mode with the CMODE instruction. The display mode is automatically set when the PC CPU power supply is turned on, the PC CPU is reset, or when the PC CPU state is changed from STOP to RUN.

(2) If the PC CPU state is changed from STOP to RUN while the enlarged display mode is set with the AD57, the display will not be incorrect.
Correct display is possible by setting the enlarged display mode while the PC CPU is running.

(3) To execute the canvas display instruction (CPS1), the canvas transmission instruction (CMOV), the screen clear instruction (CLS), or the VRAM clear instruction (CLV) in partial processing mode, always take interlock as shown below so that other instructions cannot be executed by the same AD57(S1)/AD58.
While a partial processing instruction is executed, CPS1, CMOV, CLS, and CLV instructions cannot executed by other AD57(S1)/AD58.
If such instructions are executed, correct display is impossible.



REMARK

The partial processing function is added to the instructions which require longer than 4 msec processing time if processed in batch. When partial processing is executed for such instructions, the instruction is processed in several scans. Therefore, processing time per scan can be shortened.

4. AD57(S1)/AD58 CONTROL INSTRUCTIONS

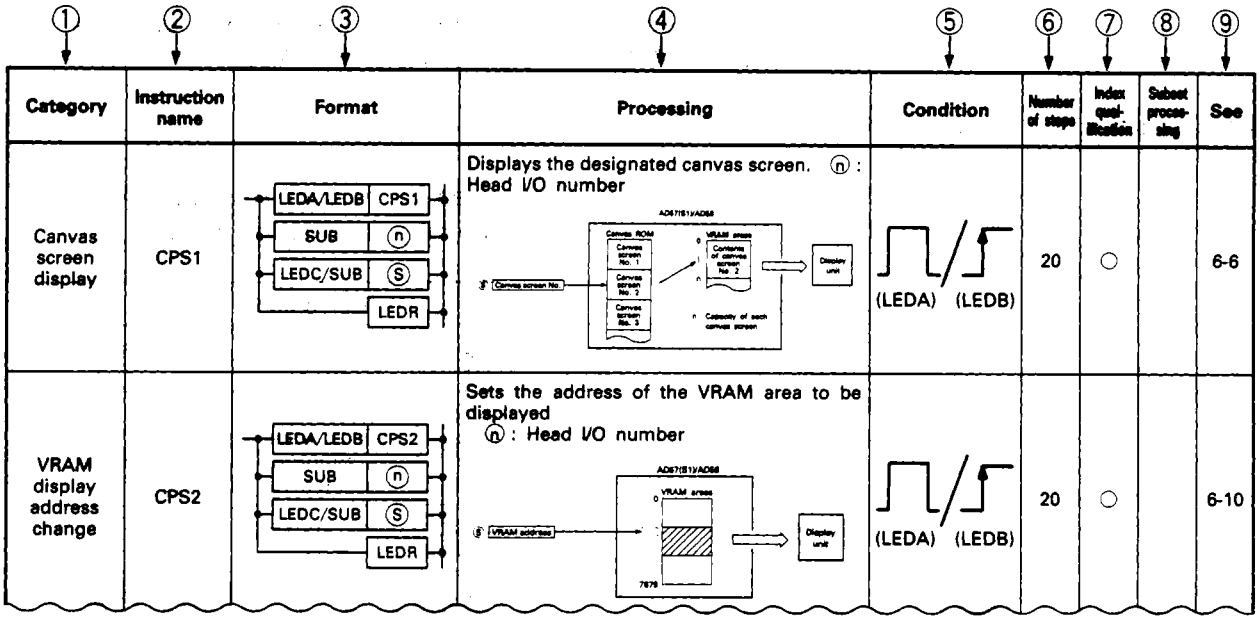
This chapter describes the dedicated instructions used by the A2ACPU(S1)/A3ACPU to control AD57(S1)/AD58.

4.1 Classification of Instructions

The dedicated instructions used to control AD57(S1)/AD58 are largely classified into the following instruction groups.

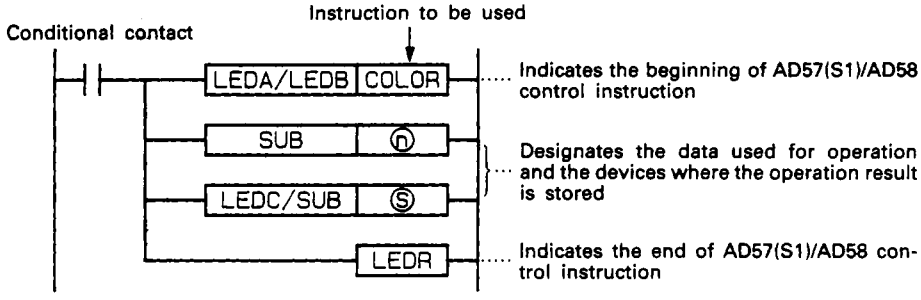
Category	Description
Display mode setting instruction	Sets the display mode according to the display unit connected to AD57(S1)/AD58.
Display screen control instructions	Execute the following: Clearing screen and VRAM area, display and transmission of canvas screen, changing display address, and controlling the display such as scrolling
Cursor control Instructions	Control cursor; cursor movement, cursor display (visible/invisible)
Display condition setting instructions	Set the conditions to display characters; designation character color, normal/reverse display, etc.
Designated character display instructions	Display the designated characters
Fixed character display instructions	Display the predetermined characters; alphanumerics, minus/hyphen, period/decimal point, etc.)
Designated column clear instruction	Clears the designated column on the screen.
ASCII code conversion instruction	Converts the ASCII characters displayed on the screen into the ASCII codes and stores them in the designated devices.
VRAM data read/ write instructions	Reads the designated data in VRAM area to store it into devices, or writes the data stored in devices to the VRAM area.
Display state read instruction	Reads the screen display state (VRAM display address, cursor state, etc.)

4.2 How to Read Instruction Lists



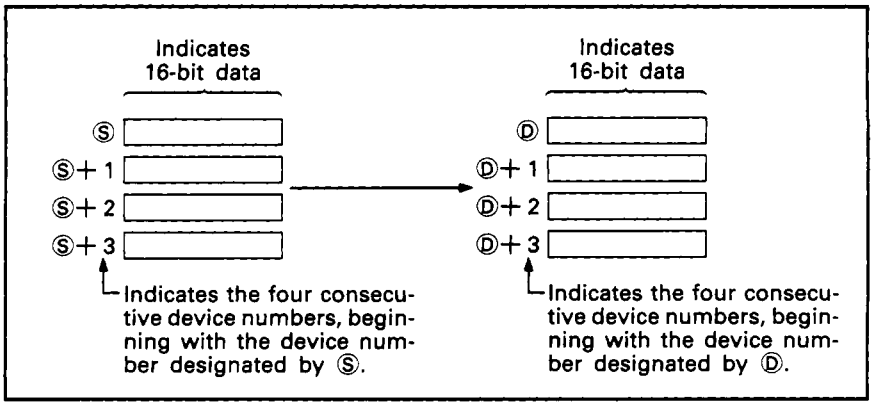
① Category	② Instruction name	③ Format	④ Processing	⑤ Condition	⑥ Number of steps	⑦ Index qualification	⑧ Subset processing	⑨ See
Canvas screen display	CPS1	LEDA/LEDB CPS1 SUB ⓝ LEDC/SUB Ⓢ LEDR	Displays the designated canvas screen. ⓝ : Head I/O number	(LEDA) (LEDB)	20	○		6-6
VRAM display address change	CPS2	LEDA/LEDB CPS2 SUB ⓝ LEDC/SUB Ⓢ LEDR	Sets the address of the VRAM area to be displayed ⓝ : Head I/O number	(LEDA) (LEDB)	20	○		6-10

① ····· Category of the instructions
② ····· Symbols to be used in writing a sequence program
③ ····· Format of an instruction to be used in writing a ladder of a sequence program.

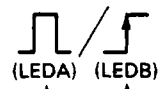

Instruction to be used
Conditional contact
LEDA/LEDB COLOR
SUB ⓝ
LEDC/SUB Ⓢ
LEDR
..... Indicates the beginning of AD57(S1)/AD58 control instruction
Designates the data used for operation and the devices where the operation result is stored
..... Indicates the end of AD57(S1)/AD58 control instruction

For details, refer to Chapter 5.

④ ····· Details of instruction processing contents

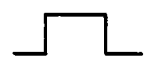


⑤ ····· Instruction execution timing



Indicates the four consecutive device numbers, beginning with the device number designated by (D).o execute LEDB instruction.

Indicates the four consecutive device numbers, beginning with the device number designated by (D).o execute LEDA instruction.

Symbol	Execution timing
	An instruction is executed every scan while the condition to execute the instruction is satisfied (ON).
	An instruction is executed only once at the leading edge (OFF to ON) of the instruction execution condition.

⑥ ····· The number of steps
Depending on the devices to be used, the number of steps actually required might become larger than the step number indicated here.
For details, refer to Section 5.2.

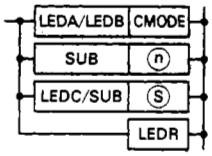
⑦ ····· A circle in this column shows that an index register (Z, V) can be used for the devices or constants used by an instruction.

⑧ ····· A circle in this column shows that subset processing is possible.

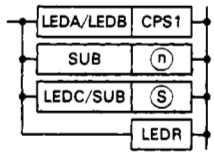
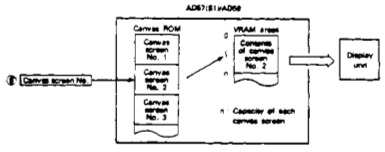
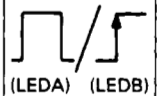
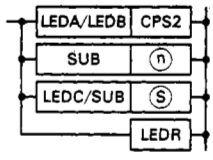
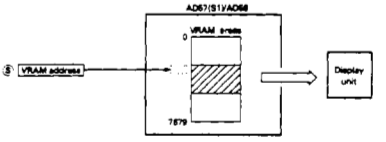
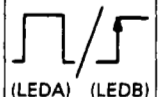
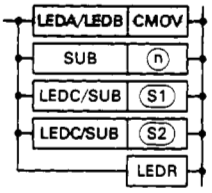
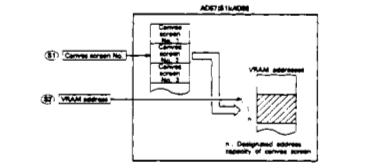
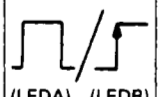
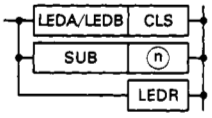
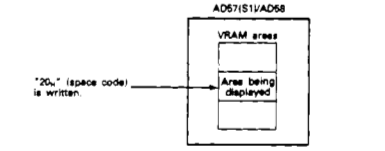
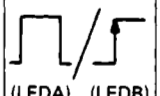
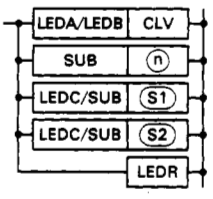
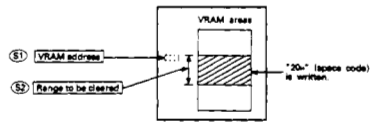
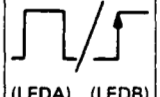
⑨ ····· Shows the manual page in which detailed description of the instruction is given.

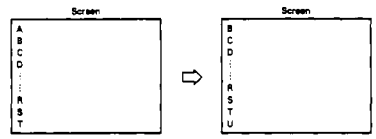
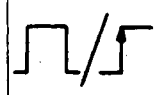
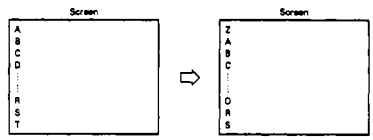
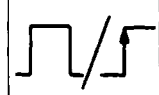
4.3 AD57(S1)/AD58 Control Instruction Lists

(1) Display mode setting instruction

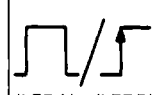
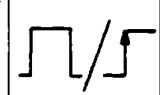
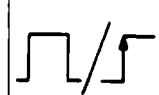
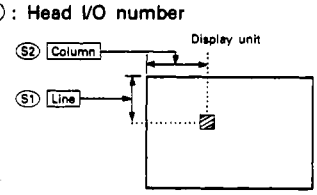
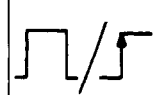
Category	Instruction name	Format	Processing	Condition	Number of steps	Index qualification	Subset processing	See
Display mode setting	CMODE		Sets the display mode. ⓝ : Head I/O number Ⓢ : Display mode setting code 0 ···· Color CRT, standard display mode (AD57) 1 ···· Enlarged display mode (AD57) 2 ···· LCD mode (AD58) 3 ···· Monochrome CRT, standard display mode (AD57) 5 ···· Color CRT, standard display mode (AD57-S1)		20	○		6-2

(2) Display screen control instructions

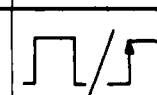
Category	Instruction name	Format	Processing	Condition	Number of steps	Index qualification	Subset processing	See
Canvas screen display	CPS1		Displays the designated canvas screen. ⓝ : Head I/O number 		20	○		6-6
VRAM display address change	CPS2		Sets the address of the VRAM area to be displayed ⓝ : Head I/O number 		20	○		6-10
Canvas transmission	CMOV		Transmits the designated canvas screen to the designated address in the VRAM area ⓝ : Head I/O number 		23	○		6-14
Screen clear	CLS		Clears the screen displayed in the display unit. ⓝ : Head I/O number 		17	○		6-19
VRAM clear	CLV		Clears the designated size of VRAM area beginning with the designated address ⓝ : Head I/O number 		23	○		6-23

Category	Instruction name	Format	Processing	Condition	Number of steps	Index qualification	Subset processing	See
Scroll up/down	CSCRU	LEDA/LEDB CSCRU SUB (n) LEDR	Increases VRAM area display address by one line and scrolls the display up by one line. (n) : Head I/O number 	 (LEDA) (LEDB)	17	○		6-27
	CSCRD	LEDA/LEDB CSCRD SUB (n) LEDR	Decreases VRAM area display address by one line and scrolls the display down by one line. (n) : Head I/O number 	 (LEDA) (LEDB)	17	○		6-27

(3) Cursor control instructions

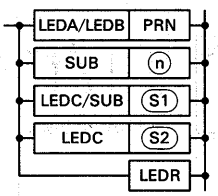
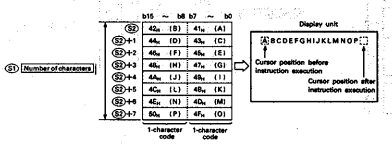
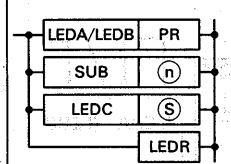
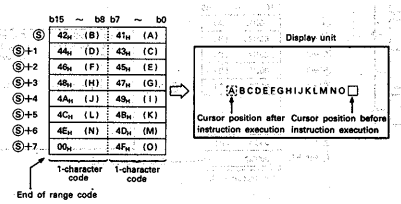
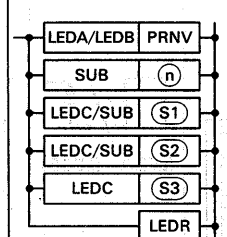
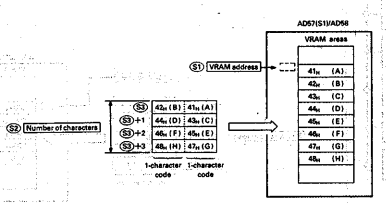
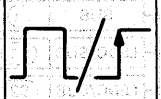
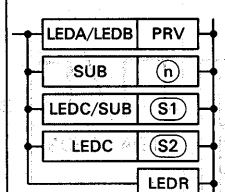
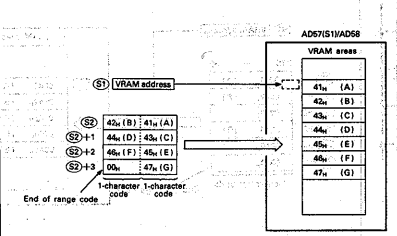
Category	Instruction name	Format	Processing	Condition	Number of steps	Index qualification	Subset processing	See
Cursor display	CON1	LEDA/LEDB CON1 SUB (n) LEDR	Displays the cursor having one-character size. (n) : Head I/O number	 (LEDA) (LEDB)	17	○		6-32
	CON2	LEDA/LEDB CON2 SUB (n) LEDR	Displays the cursor having two-character size. (n) : Head I/O number	 (LEDA) (LEDB)	17	○		6-32
Deleting cursor	COFF	LEDA/LEDB COFF SUB (n) LEDR	Deletes the cursor on the screen. (n) : Head I/O number	 (LEDA) (LEDB)	17	○		6-35
Cursor position setting	LOCATE	LEDA/LEDB LOCATE SUB (n) LEDC/SUB (S1) LEDC/SUB (S2) LEDR	Moves the cursor to the designated position on the screen. (n) : Head I/O number 	 (LEDA) (LEDB)	23	○		6-37

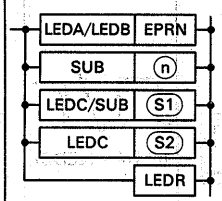
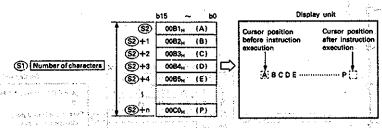
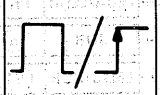
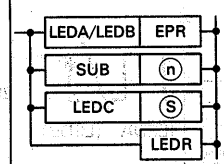
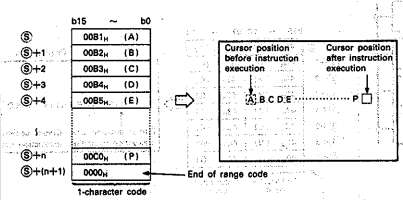
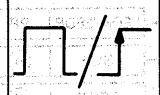
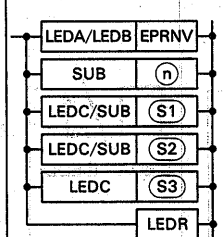
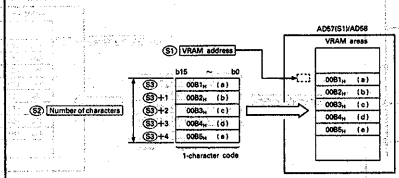
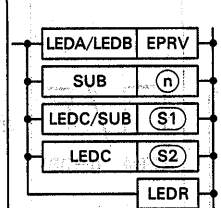
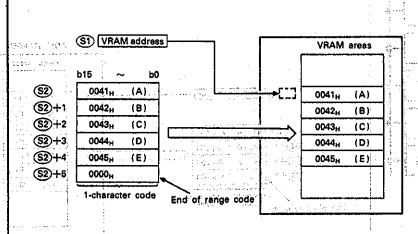
(4) Display condition setting instructions

Category	Instruction name	Format	Processing	Condition	Number of steps	Index qualification	Subset processing	See
Normal/ reverse display of characters	CNOR	LEDA/LEDB CNOR SUB (n) LEDR	Sets the normal display of characters. (n) : Head I/O number	 (LEDA) (LEDB)	17	○		6-41
	CREV	LEDA/LEDB CREV SUB (n) LEDR	Sets the reverse display of characters. (n) : Head I/O number	 (LEDA) (LEDB)	17	○		6-41

Category	Instruction name	Format	Processing	Condition	Number of steps	Index qualification	Subset processing	See
Changing normal/ reverse display of characters	CRDSP	LEDA/LEDB CRDSP SUB (n) LEDC/SUB (S) LEDR	Changes normal/reverse display mode for the designated number of characters beginning with the cursor-located character. (n) : Head I/O number	(LEDA) (LEDB)	20	○		6-44
	CRDSPV	LEDA/LEDB CRDSPV SUB (n) LEDC/SUB (S1) LEDC/SUB (S2) LEDR	Changes normal/reverse display mode for the designated number of characters beginning with the designated address in the VRAM area. (n) : Head I/O number	(LEDA) (LEDB)	23	○		6-48
Character color designation	COLOR	LEDA/LEDB COLOR SUB (n) LEDC/SUB (S) LEDR	Sets the color of characters to be displayed. (n) : Head I/O number (S) : Color code	(LEDA) (LEDB)	20	○		6-51
Changing character color	CCDSP	LEDA/LEDB CCDSP SUB (n) LEDC/SUB (S1) LEDC/SUB (S2) LEDR	Changes the color of the designated number of characters beginning with the cursor-located character. (n) : Head I/O number	(LEDA) (LEDB)	23	○		6-54
	CCDSPV	LEDA/LEDB CCDSPV SUB (n) LEDC/SUB (S1) LEDC/SUB (S2) LEDC/SUB (S3) LEDR	Changes the color of the designated number of characters beginning with designated address in the VRAM area. (n) : Head I/O number	(LEDA) (LEDB)	26	○		6-59

(5) Designated character display instructions

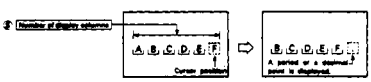
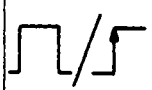
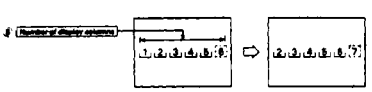
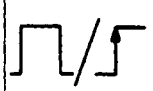
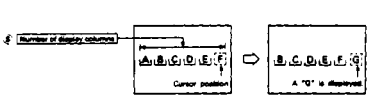
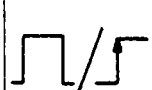
Category	Instruction name	Format	Processing	Condition	Number of steps	Index qualification	Subset processing	See
ASCII character display	PRN		Displays the designated number of ASCII characters stored in the devices following the designated device. (n) : Head I/O number 		23	○		6-64
	PR		Displays the ASCII characters stored in the devices beginning with the designated device and up to the device which stores the 00H code. (n) : I/O number 		20	○		6-68
Writing ASCII characters	PRNV		Writes the designated number of ASCII characters stored in the devices following the designated device to the addresses in the VRAM area beginning with the designated address. (n) : Head I/O number 		20	○		6-72
	PRV		Writes the ASCII characters stored in the devices beginning with the designated device and up to the device which stores the 00H code to the addresses in the VRAM area beginning with the designated address. (n) : Head I/O number 		23	○		6-76

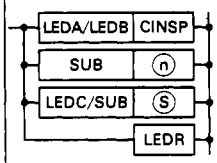
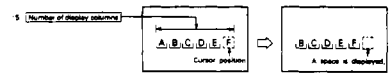
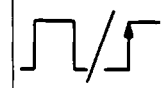
Category	Instruction name	Format	Processing	Condition	Number of steps	Index qualification	Subset processing	See
Continuous display of the same character	EPRN		Displays the designated number of the designated character to the right beginning from the cursor position. (n) : Head I/O number 		23	○		6-80
	EPR		Displays the characters stored in the devices beginning with the designated device and up to the device storing the 00H code. (n) : Head I/O number 		20	○		6-84
Writing characters	EPRNV		Writes the designated number of characters stored in the devices following the designated device to the addresses in the VRAM area beginning with the designated address. (n) : Head I/O number 		26	○		6-88
	EPRV		Writes the characters stored in the devices beginning with the designated device and up to the device which stores the 00H code to the addresses in the VRAM area beginning with the designated address. (n) : Head I/O number 		23	○		6-91

Category	Instruction name	Format	Processing	Condition	Number of steps	Index qualification	Subset processing	See
Continuous display of the same character(s)	CR1	LEDA/LEDB CR1 SUB (n) LEDC/SUB (S1) LEDC/SUB (S2) LEDR	Displays the designated number of designated characters to the right beginning from the cursor position. (n) : Head I/O number (S2) Number of characters (S1) Character code A A A A A A Cursor position before instruction execution Cursor position after instruction execution	(LEDA) (LEDB)	23	○		6-94
	CR2	LEDA/LEDB CR2 SUB (n) LEDC/SUB (S1) LEDC/SUB (S2) LEDC/SUB (S3) LEDR	Displays the designated number of the designated two different characters in pairs to the right beginning from the cursor position. (n) : Head I/O number (S3) Number of characters (S1) Character code (S2) Character code Cursor position before instruction execution Cursor position after instruction execution	(LEDA) (LEDB)	26	○		6-97
	CC1	LEDA/LEDB CC1 SUB (n) LEDC/SUB (S1) LEDC/SUB (S2) LEDR	Displays the designated number of designated characters downward beginning from the cursor position. (n) : Head I/O number (S1) Number of characters (S2) Character code A A A A A Cursor position before instruction execution Cursor position after instruction execution	(LEDA) (LEDB)	23	○		6-101
	CC2	LEDA/LEDB CC2 SUB (n) LEDC/SUB (S1) LEDC/SUB (S2) LEDC/SUB (S3) LEDR	Displays the designated number of the designated two different characters in pairs downward beginning from the cursor position. (n) : Head I/O number (S3) Number of characters (S1) Character code (S2) Character code Cursor position after instruction execution Cursor position before instruction execution	(LEDA) (LEDB)	26	○		6-104

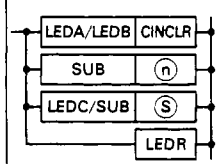
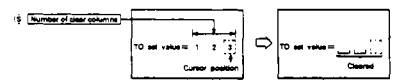
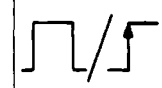
(6) Fixed character display instructions

Category	Instruction name	Format	Processing	Condition	Number of steps	Index qualification	Subset processing	See
"—" (minus symbol) display	CINMP	LEDA/LEDB CINMP SUB (n) LEDC/SUB (S) LEDR	Displays the "—" (minus symbol) at the position left to the cursor position by the designated number of columns. (n) : Head I/O number (S) Number of display columns "—" is displayed Cursor position	(LEDA) (LEDB)	20	○		6-108
"-" (hyphen) display	CINHP	LEDA/LEDB CINHP SUB (n) LEDC/SUB (S) LEDR	Displays the "-" (hyphen) at the cursor position. (n) : Head I/O number A B C D E F Cursor position A hyphen is displayed.	(LEDA) (LEDB)	20	○		6-111

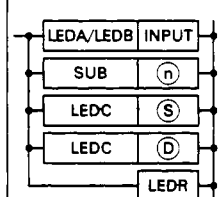
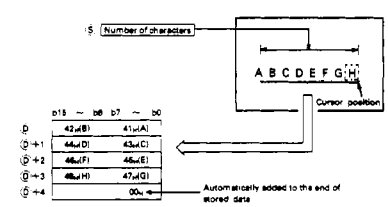
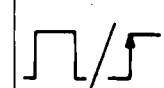
Category	Instruction name	Format	Processing	Condition	Number of steps	Index qualification	Subset processing	See
"." (period) display	CINPT	LEDA/LEDB CINPT SUB (n) LEDC/SUB (S) LEDR	Displays the "." (period) at the cursor position. (n) : Head I/O number 	 (LEDA) (LEDB)	20	○		6-114
Display of number	CIN0 to CIN9	LEDA/LEDB *1 SUB (n) LEDC/SUB (S) LEDR *1: CIN0 CIN1 CIN2 CIN3 CIN4 CIN5 CIN6 CIN7 CIN8 CIN9	Displays the number corresponding to an instruction at the cursor position. (n) : Head I/O number CIN0 ····· Displays "0", CIN1 ····· Displays "1" CIN2 ····· Displays "2", CIN3 ····· Displays "3" CIN4 ····· Displays "4", CIN5 ····· Displays "5" CIN6 ····· Displays "6", CIN7 ····· Displays "7" CIN8 ····· Displays "8", CIN9 ····· Displays "9" 	 (LEDA) (LEDB)	20	○		6-117
Display of alphabet	CINA to CINZ	LEDA/LEDB *1 SUB (n) LEDC/SUB (S) LEDR *1: CIN A CIN B CIN C CIN D CIN E CIN F CIN G CIN H CIN I CIN J CIN K CIN L CIN M CIN N CIN O CIN P CIN Q CIN R CIN S CIN T CIN U CIN W CIN X CIN Y CIN Z	Displays the alphabet corresponding to an instruction at the cursor position. (n) : Head I/O number CIN A ····· Displays "A", CIN B ····· Displays "B" CIN C ····· Displays "C", CIN D ····· Displays "D" CIN E ····· Displays "E", CIN F ····· Displays "F" CIN G ····· Displays "G", CIN H ····· Displays "H" CIN I ····· Displays "I", CIN J ····· Displays "J" CIN K ····· Displays "K", CIN L ····· Displays "L" CIN M ····· Displays "M", CIN N ····· Displays "N" CIN O ····· Displays "O", CIN P ····· Displays "P" CIN Q ····· Displays "Q", CIN R ····· Displays "R" CIN S ····· Displays "S", CIN T ····· Displays "T" CIN U ····· Displays "U", CIN V ····· Displays "V" CIN W ····· Displays "W". CIN X ····· Displays "X" CIN Y ····· Displays "Y", CIN Z ····· Displays "Z" 	 (LEDA) (LEDB)	20	○		6-117

Category	Instruction name	Format	Processing	Condition	Number of steps	Index qualification	Subset processing	See
Display of space	CINSP		Displays a " " (space) at the cursor position. ⓝ : Head I/O number 	 (LEDA) (LEDB)	20	○		6-121

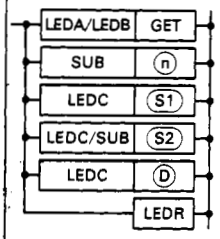
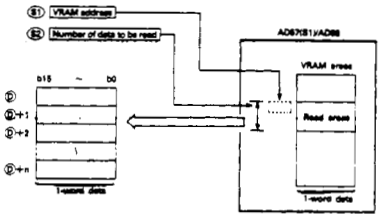
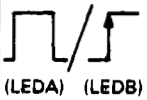
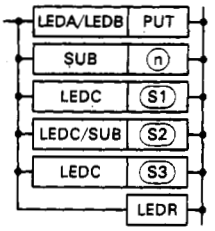
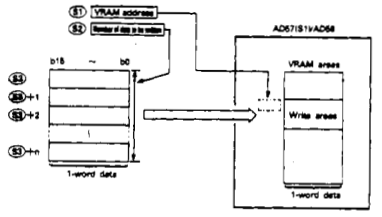
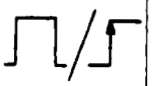
(7) Designated column clear instruction

Category	Instruction name	Format	Processing	Condition	Number of steps	Index qualification	Subset processing	See
Designated column	CINCLR		Clears the designated number of characters from the cursor position in the left. ⓝ : Head I/O number 	 (LEDA) (LEDB)	20	○		6-125

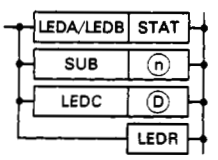
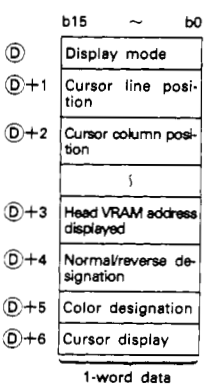
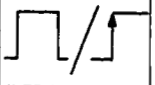
(8) ASCII code conversion instruction

Category	Instruction name	Format	Processing	Condition	Number of steps	Index qualification	Subset processing	See
ASCII code conversion	INPUT		Converts the designated number of characters from the cursor position in the left into the ASCII code and stores the designated device. ⓝ : Head I/O number 	 (LEDA) (LEDB)	23	○		6-129

(9) VRAM data read/write instructions

Category	Instruction name	Format	Processing	Condition	Number of steps	Index qualification	Subset processing	See
Read VRAM data	GET		Reads the screen data in the designated range of the VRAM area to the designated devices. ⓝ : Head I/O number 		26	○		6-134
Write VRAM data	PUT		Writes the character data stored in the designated devices by the designated words to the designated VRAM area addresses. ⓝ : Head I/O number 		26	○		6-139

(10) Reading display state

Category	Instruction name	Format	Processing	Condition	Number of steps	Index qualification	Subset processing	See
Read display state	STAT		Reads the screen display state set in the AD57(S1)/AD58. 		20	○		6-145

MEMO

5. USING AD57(S1)/AD58 CONTROL INSTRUCTIONS

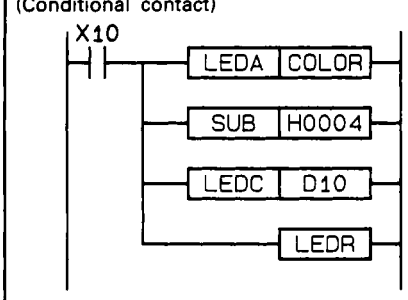
This chapter describes how to use the instructions which control the AD57(S1)/AD58 with the A2A(S1)/A3ACPU.

5.1 Stating Instructions

This section describes the procedure to state AD57(S1)/AD58 control instructions.

The AD57(S1)/AD58 control instructions are stated in combination with an LEDA, LEDB, LEDC, LEDR, or SUB instruction.

Statement in Ladder Form	Statement in Instruction List Form



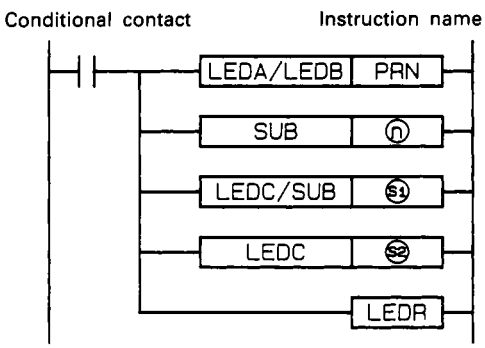
Stating an instruction

Designates the data used for operation and the devices where the operation result is stored

Indicates the end of the AD57(S1)/AD58 control instruction

LD	X10
LEDA	COLOR
SUB	H0004
LEDC	D10
LEDR	

With the format in the instruction list in Section 4.3 and in the detailed description of instructions given in Chapter 6, the instructions are stated in the following format.



(1) The LEDA, LEDB, LEDC, LEDR, and SUB instructions are used in the following manner.

| LEDA/LEDB | Instruction name | ····· This indicates the beginning of an AD57(S1)/AD58 control instruction.

| LEDA | instruction name | : An instruction is executed every scan while the conditional contact is ON.

| LEDB | instruction name | : An instruction is executed only once at the leading edge of the conditional contact.

| LEDC/SUB | (S1) ····· These designate the device for setting the data used for an operation called by an instruction and the device for storing the operation result.

| LEDC | (S) ·····

| SUB | (S2) ·····

| LEDC/SUB | (S1) | : This indicates that either LEDO or SUB can be designated.

| LEDC | (S) | : This indicates that only LEDC can be designated.

| SUB | (S2) | : This indicates that only SUB can be designated.

The LEDC instruction is used to set a device number.

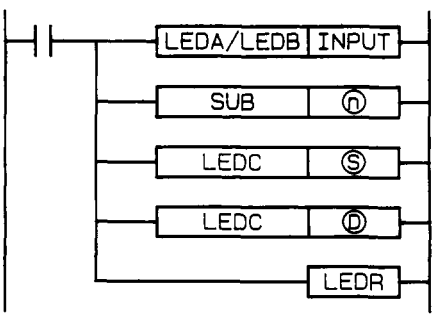
| LEDC | D0 |, | LEDC | W10A |

The SUB instruction is used to set a 16 bit constant. Setting range is either "−32768 to 32767" or "0000_H to $FFFF_H$".

| SUB | K32767 |, | SUB | HFFFF |

| LEDR | ····· This indicates the end of the AD57(S1)/AD58 control instruction.
In some cases, this statement is not necessary.

(2) (n), (S), and (D) written with the LEDC or SUB instruction are used to designate the following.



(n) ·····Designates the head I/O number of the AD57(S1)/AD58 (designates the upper 2 digits in the expressed 3 digits)
(S) ·····Designates the data to be written or designation value, or the device where either of them is stored.
(D) ·····Designates the device number where the read data is stored.

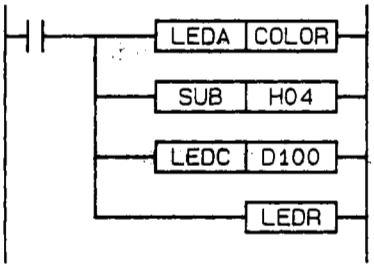
5.2 Number of Instruction Steps

The number of instruction steps increases one when each of the following device numbers (devices extended by the AnACPU) is used with the control instructions.

Device Name		Device Number Range
Internal relay (M, L, S)		2048 to 8191
Timer (T)		256 to 2047
Counter (C)		256 to 1023
Data register (D)		1024 to 6143
Link register (W)		400 to FFF
Annunciator (F)		256 to 2047
Index register	(Z)	1 to 6
	(V)	1 to 6

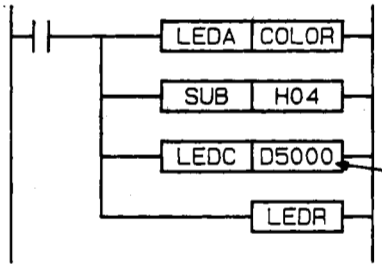
Example

• When extended devices are not used:



Number of steps = 20

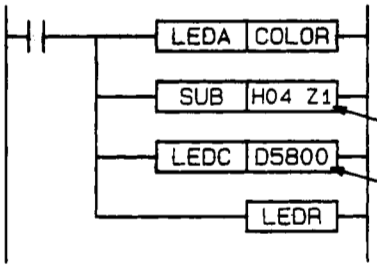
• When extended devices are used:



Number of steps = 20 + 1 = 21

Increase due to extended device

Extended device



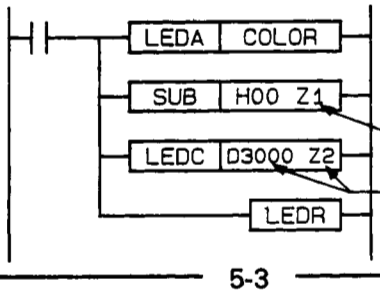
Number of steps = 20 + 1 + 1 = 22

Extended device

Extended device

Increase due to extended device (D5800)

Increase due to extended device (Z1)



Number of steps = 20 + 1 + 1 = 22

Extended device

Extended device

Increase due to extended device (D3000 Z2)

Increase due to extended device (Z1)

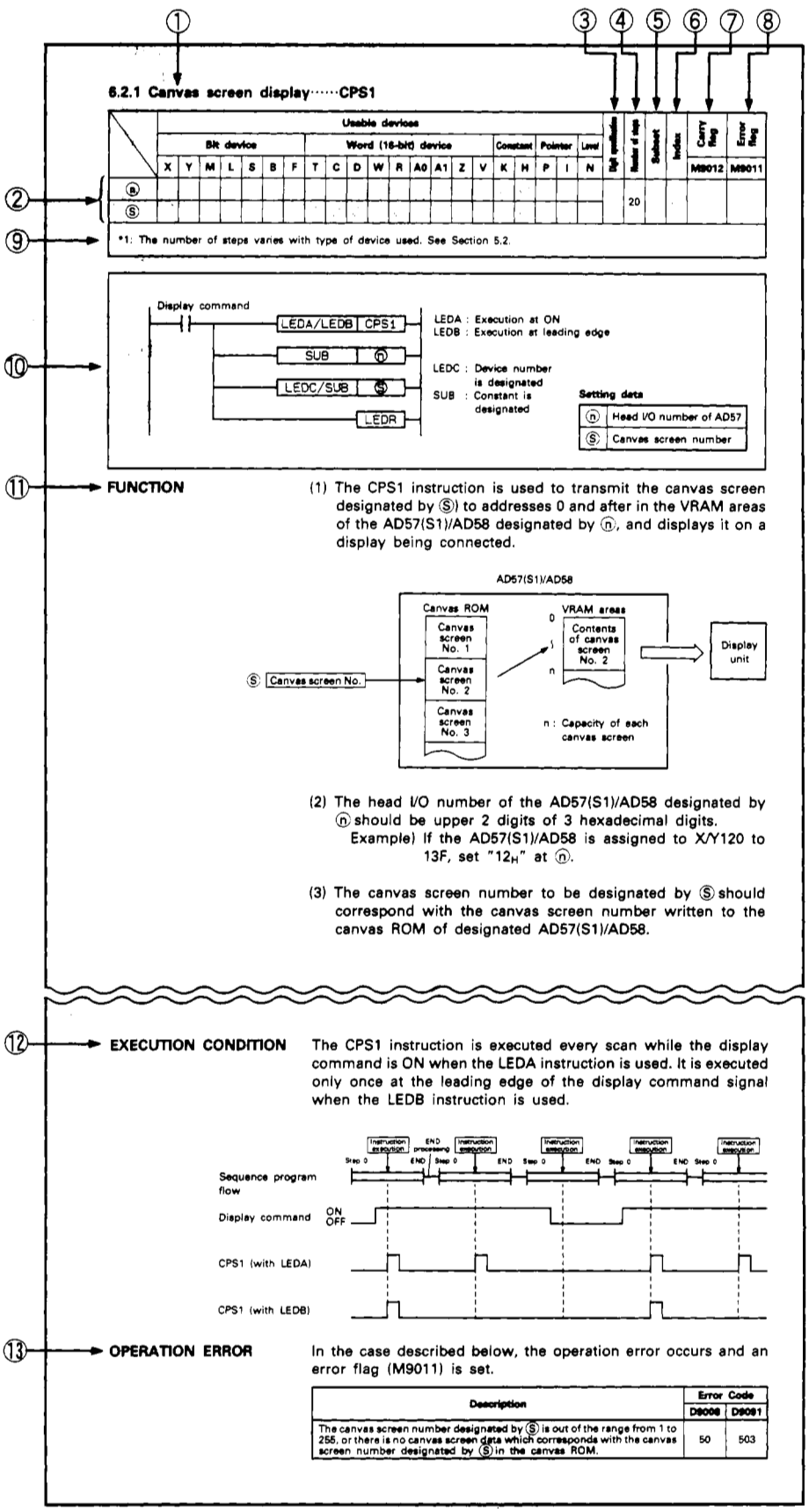
5.3 Cautions on Using Dedicated Instructions

(1) An AD57(S1)/AD58 control instruction consists of a group of instructions beginning from LEDA/LEDB and ending with LEDR.
Therefore, if an instruction not conforming to the predetermined format is stated within this range, it causes an error. An error also occurs if the instruction statement differs from the predetermined format.

(2) With the A2ACPU(S1)/A3ACPU, device number is not checked when index qualification is written to increase processing speed. Note that device number is checked only for file register (R).
Therefore, processing might be executed for devices exceeding the final device number if index qualification is not written correctly. Or, processing might be executed for other devices if "0" is exceeded, or the PC CPU might malfunction. (This does not cause an error.)

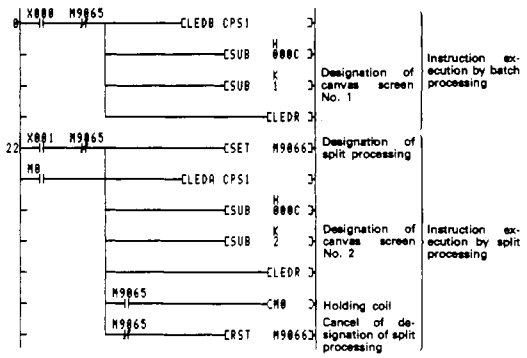
5.4 How To Read Instruction Explanation

This section describes how to read the detailed explanation of instructions given in Chapter 6.


①
③ ④ ⑤ ⑥ ⑦ ⑧
6.2.1 Canvas screen display·····CPS1
Usable devices
Bit device
Word (16-bit) device
Constant
Pointer
Level
Bit specification
Number of steps
Subset
Index
Carry flag
Error flag
X Y M L S B F T C D W R A0 A1 Z V K H P I N
M9012 M9011
Ⓑ
Ⓢ
20
②
⑨
*1: The number of steps varies with type of device used. See Section 5.2.
⑩
Display command
LEDA/LEDB CPS1
SUB Ⓝ
LEDC/SUB Ⓢ
LEDR
LEDA : Execution at ON
LEDB : Execution at leading edge
LEDC : Device number is designated
SUB : Constant is designated
Setting data
Ⓝ Head I/O number of AD57
Ⓢ Canvas screen number
⑪
FUNCTION
(1) The CPS1 instruction is used to transmit the canvas screen designated by Ⓢ) to addresses 0 and after in the VRAM areas of the AD57(S1)/AD58 designated by Ⓝ, and displays it on a display being connected.
AD57(S1)/AD58
Canvas ROM
Canvas screen No. 1
Canvas screen No. 2
Canvas screen No. 3
VRAM areas
0
Contents of canvas screen No. 2
n
n : Capacity of each canvas screen
Display unit
Ⓢ Canvas screen No.
(2) The head I/O number of the AD57(S1)/AD58 designated by Ⓝ should be upper 2 digits of 3 hexadecimal digits.
Example) If the AD57(S1)/AD58 is assigned to X/Y120 to 13F, set "12H" at Ⓝ.
(3) The canvas screen number to be designated by Ⓢ should correspond with the canvas screen number written to the canvas ROM of designated AD57(S1)/AD58.
⑫
EXECUTION CONDITION
The CPS1 instruction is executed every scan while the display command is ON when the LEDA instruction is used. It is executed only once at the leading edge of the display command signal when the LEDB instruction is used.
Sequence program flow
Display command
ON
OFF
CPS1 (with LEDA)
CPS1 (with LEDB)
⑬
OPERATION ERROR
In the case described below, the operation error occurs and an error flag (M9011) is set.
Description
Error Code
D9008
D9091
The canvas screen number designated by Ⓢ is out of the range from 1 to 255, or there is no canvas screen data which corresponds with the canvas screen number designated by Ⓢ in the canvas ROM.
50
503

⑭ ► PROGRAM EXAMPLE

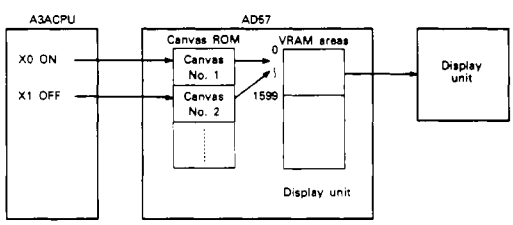
The following is an example of the program used to display canvas screens on the AD57 loaded at X/Y0C0 to 0FF.
When X000 is turned ON, canvas screen No. 1 is displayed by batch processing. When X001 is turned ON, canvas screen No. 2 is displayed by split processing.



Designation of batch/split processing is done by setting M9066 as follows.

When M9066 is OFF ..... Batch processing
When M9066 is ON ..... Split processing

M9065 is the split processing flag and used to provide interlock so that other instructions may not be executed during split processing.
M0 is used to hold so that the CPS1 instruction may be executed till split processing is completed.



① Shows the function of an instruction and instruction symbol.
② A circle indicates the device that can be used with the instruction.
③ A circle indicates that the instruction requires designation of digits when a bit device is used.
④ This column indicates the number of steps occupied by the instruction.
For details of the number of steps, refer to Section 5.2.
⑤ A circle indicates that the subset processing is possible.
⑧ A circle indicates that index qualification (Z, V) is possible.
⑦ A circle indicates that the ON/OFF state of the carry flag (M9012) changes according to the result of execution of the instruction.
⑧ A circle indicates that the error flag (M9011) is set if an operation error occurs.
⑨ This indicates precautions concerning ② to ⑧ above. If an asterisk (*) is given, always read the precaution.
⑩ This indicates the format of the instruction stated using ladder diagram.
⑪ This explains the details of the instruction.
⑫ This indicates the instruction execution timing.
⑬ This indicates conditions causing an operation error and the error code of the operation error.
⑭ A program example in which the instruction is used is shown using ladder diagram.

MEMO

6. AD57(S1)/AD58 CONTROL INSTRUCTIONS

This section describes details of instructions used to control the AD57(S1)/AD58.

6.1 Display Mode Setting Instruction

The display mode setting instruction is used to execute display mode setting of the AD57(S1)/AD58 according to the type of the display being connected.
By execution of display mode setting, the AD57(S1)/AD58 can display characters. Correct display of characters is not available without proper display mode setting.
If module type setting has been done by parameter setting, display mode setting is not necessary.
When the PC CPU is switched from STOP to RUN, the following display modes are automatically set.

When AD57 is set ·····"0" (AD57 CRT standard mode)
When AD57-S1 is set ····"5" (AD57-S1 CRT standard mode)
When AD58 is set ·····"2" (LCD mode)

For detail of module type registration, refer to the SW4GP-GPPA Operating Manual.
Display mode setting is used also to switch display mode between standard and enlarged for the AD57.

Display mode setting is executed using the instruction mentioned below.

Category	Instruction Name	Description
Display mode setting	CMODE	Sets display mode of the AD57(S1)/AD58. Switches display mode of the AD57 between standard and enlarged.

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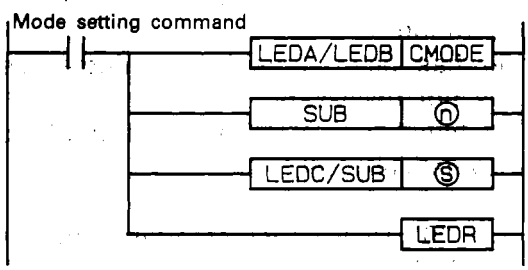
6.1.1 Display mode setting·····CMODE

	Usable devices																				Digit specification	Number of steps	Subset	Index	Carry flag	Error flag
	Bit device							Word (16-bit) device									Constant		Pointer		Level					
	X	Y	M	L	S	B	F	T	C	D	W	R	A0	A1	Z	V	K	H	P	I	N				M9012	M9011
ⓝ																	○	○					20			○
Ⓢ								○	○	○	○	○					○	○						○		

*1: The number of steps varies with type of device used. See Section 5.2.



LEDA : Execution at ON
LEDB : Execution at leading edge

LEDC : Device number is designated
SUB : Constant is designated

Setting data

ⓝ	Head I/O number of AD57
Ⓢ	Display mode setting data

FUNCTION

(1) The CMODE instruction is used to set the display mode designated by Ⓢ to the AD57(S1)/AD58 designated by ⓝ. By execution of display mode setting, display of characters on the display unit connected to the AD57(S1)/AD58 becomes possible.
Correct display of characters is not possible without proper display mode setting.

(2) The head I/O number of the AD57(S1)/AD58 designated by ⓝ should be upper 2 digits of 3 hexadecimal digits.
Example) If the AD57(S1)/AD58 is assigned to X/Y120 to 13F, set "12_H" at ⓝ.

(3) The display mode setting data to be designated by Ⓢ should be as follows according to type of module.
0 : Color CRT standard mode ····· for AD57
1 : Color/monochrome CRT enlarged mode ··· for AD57
2 : LCD mode ····· for AD58
3 : Monochrome CRT standard mode ····· for AD57
5 : Color CRT standard mode ····· for AD57-S1

(4) If module type of A2ACPU(S1)/A3ACPU is already set by parameters, the following data is automatically set when the A2ACPU(S1)/A3ACPU is in the RUN state.
It is not necessary to use the CMODE instruction if it is not necessary to change display mode.
When AD57 is set ····· Set "0".
When AD57(S1) is set ···· Set "5".
When AD58 is set ····· Set "2".

(5) After execution of the CMODE instruction, conditions of the display become as follows.

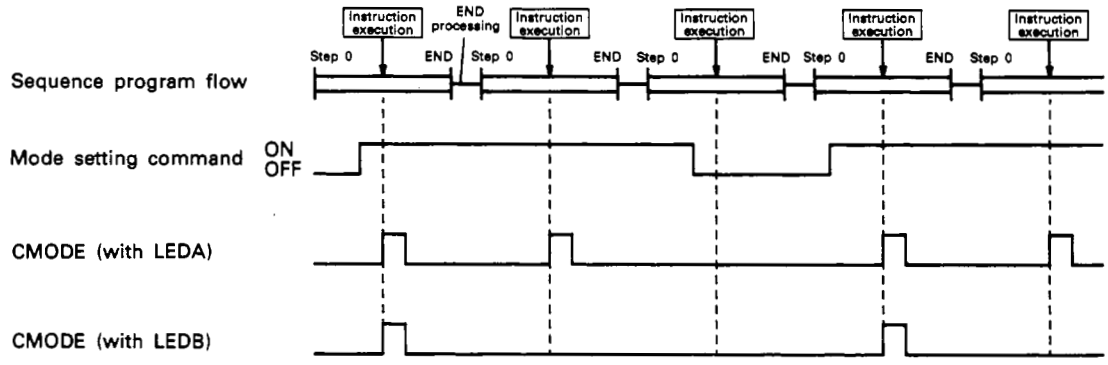
Item	Condition
Display mode	Designated data
Cursor line position	Line "0"
Cursor column position	Column "0"
Head VRAM address displayed	Address "0"
Normal/reverse designation	(no change)
Color designation	
Cursor display	Not displayed

POINT

If the CMODE instruction is executed every scan using the LEDA instruction, the screen sometimes becomes distorted momentarily. To avoid this problem, it is recommended that the CMODE instruction be executed only once at the leading edge using the LEDB instruction.

EXECUTION CONDITION

The CMODE instruction is executed every scan while the mode setting command is ON when the LEDA instruction is used. It is executed only once at the leading edge of the mode setting command signal when the LEDB instruction is used.



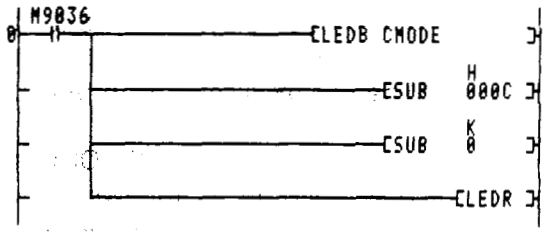
OPERATION ERROR

In the case described below, the operation error occurs and an error flag (M9011) is set.

Description	Error Code	
	D9008	D9091
The display mode setting data designated by Ⓢ is out of the range from 0 to 3 and 5.	50	503

PROGRAM EXAMPLE

The following is an example of the program used to set the CRT standard mode to the AD57 assigned to X/Y0C0 to 0FF.
Setting is executed when the PC CPU is powered on or reset.



By use of the LEDB instruction and M9036 as a conditional contact, the CMODE instruction is executed only once when the PC CPU is powered on or reset.
To set the CRT standard mode to the AD57, "0" should be designated.

6.2 Display Screen Control Instructions

The display screen control instructions are used to clear display screen and VRAM areas, display and transmit canvas screens and scroll up and down the screen.
Using the display screen control instructions, display of the canvas screen in the canvas ROM, switching of screens and scrolling of screen can be easily controlled.

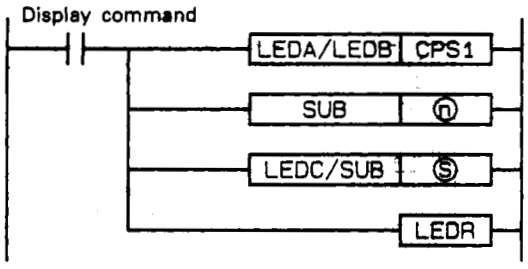
Display screen control is executed using the instructions mentioned below.

Category	Instruction Name	Description
Canvas screen display	CPS1	Reads a designated canvas screen in the canvas ROM to addresses 0 and after in the VRAM areas and displays it on the screen.
VRAM display address change	CPS2	Changes addresses of the VRAM areas displayed on the screen by one address.
Canvas screen transmission	CMOV	Transmits canvas screens in the ROM to a designated address and after in the VRAM areas.
Screen clear	CLS	Writes 20_H (space code) to the address of the VRAM areas being displayed and clears the screen.
VRAM area clear	CLV	Writes 20_H (space code) to a designated address and after in the VRAM areas.
Scroll up/down	CSCRU	Scrolls up a screen by one line.
	CSCRD	Scrolls down a screen by one line.

6.2.1 Canvas screen display·····CPS1

	Usable devices																				Digit specification	Number of steps	Subset	Index	Carry flag	Error flag
	Bit device							Word (16-bit) device									Constant		Pointer		Level						
	X	Y	M	L	S	B	F	T	C	D	W	R	A0	A1	Z	V	K	H	P	I	N					M9012	M9011
ⓝ																	○	○									
Ⓢ								○	○	○	○	○					○	○					20		○		○

*1: The number of steps varies with type of device used. See Section 5.2.



LEDA : Execution at ON
LEDB : Execution at leading edge

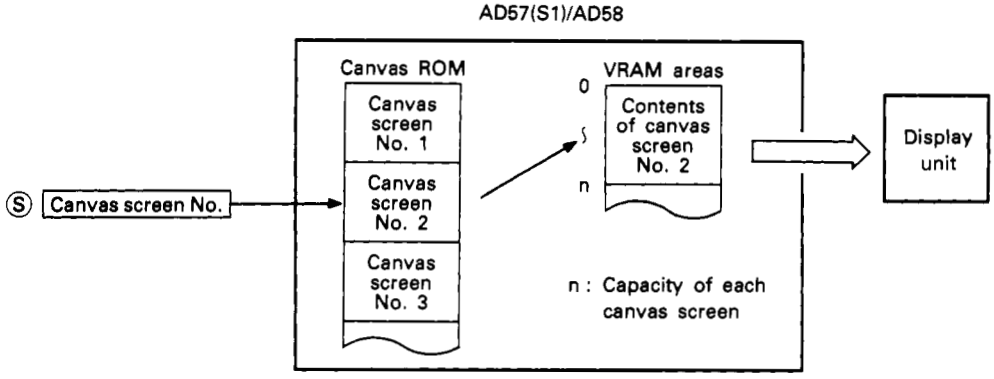
LEDC : Device number is designated
SUB : Constant is designated

Setting data

ⓝ	Head I/O number of AD57
Ⓢ	Canvas screen number

FUNCTION

(1) The CPS1 instruction is used to transmit the canvas screen designated by Ⓢ to addresses 0 and after in the VRAM areas of the AD57(S1)/AD58 designated by ⓝ, and displays it on a display being connected.



(2) The head I/O number of the AD57(S1)/AD58 designated by ⓝ should be upper 2 digits of 3 hexadecimal digits.
Example) If the AD57(S1)/AD58 is assigned to X/Y120 to 13F, set "12_H" at ⓝ.

(3) The canvas screen number to be designated by Ⓢ should correspond with the canvas screen number written to the canvas ROM of designated AD57(S1)/AD58.

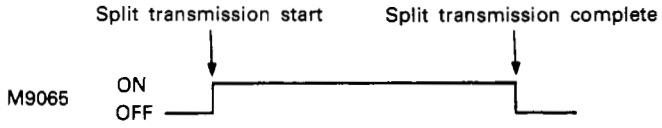
(4) There are 2 ways of transmission of canvas screens to the VRAM areas, as mentioned below. Use special relay M9066 to switch the method of transmission.

1) Batch transmission (M9066 is OFF)
Data of designated canvas screen is transmitted in batch to the VRAM areas.
The scan time in which batch transmission is performed accordingly becomes longer than that in which transmission is not performed.

2) Split transmission (M9066 is ON)
Data of designated canvas screen is transmitted by 100 words per scan.
Scan time is not lengthened so much by the transmission operation.
However, the split transmission operation requires more processing time than the batch transmission operation.

(Number of scans required for transmission processing
In the CRT standard mode ····· 16 scans
In the CRT enlarged mode ····· 4 scans
In the LCD mode ····· 8 scans)

Special relay M9065 is turned ON when split transmission is started, and turned OFF when it is completed.



POINT

(1) During split transmission, execution of other instructions cannot be accepted by the AD57(S1)/AD58 to which screen data is being transmitted.
Also, execution of the following instructions cannot be accepted by other AD57(S1)/AD58.
CPS1 instruction, CMOV instruction, CLS instruction, CLV instruction

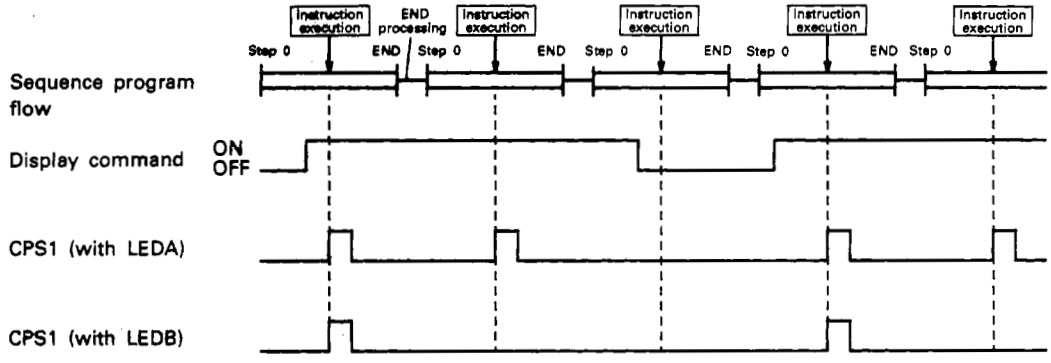
(2) The LEDB instruction cannot be used when split transmission is performed.
Display command (conditional contact) and M9066 should be held at ON during split transmission.

(5) After execution of the CPS1 instruction, conditions of the display become as follows.

Item	Condition
Display mode	(no change)
Cursor line position	Line "0"
Cursor column position	Column "0"
Head VRAM address displayed	Address "0"
Normal/reverse designation	Normal
Color designation	White
Cursor display	Not displayed

EXECUTION CONDITION

The CPS1 instruction is executed every scan while the display command is ON when the LEDA instruction is used. It is executed only once at the leading edge of the display command signal when the LEDB instruction is used.



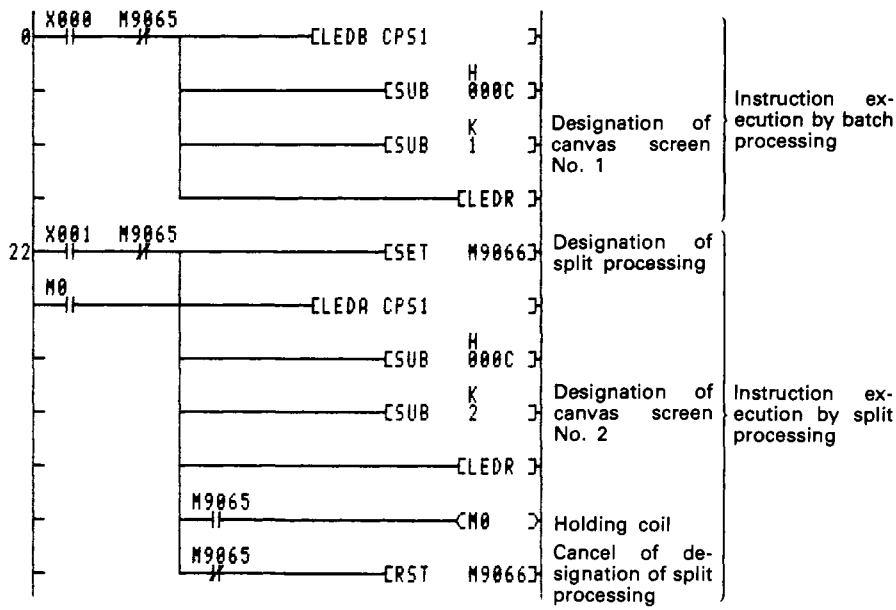
OPERATION ERROR

In the case described below, the operation error occurs and an error flag (M9011) is set.

Description	Error Code	
	D9008	D9091
The canvas screen number designated by Ⓢ is out of the range from 1 to 255, or there is no canvas screen data which corresponds with the canvas screen number designated by Ⓢ in the canvas ROM.	50	503

PROGRAM EXAMPLE

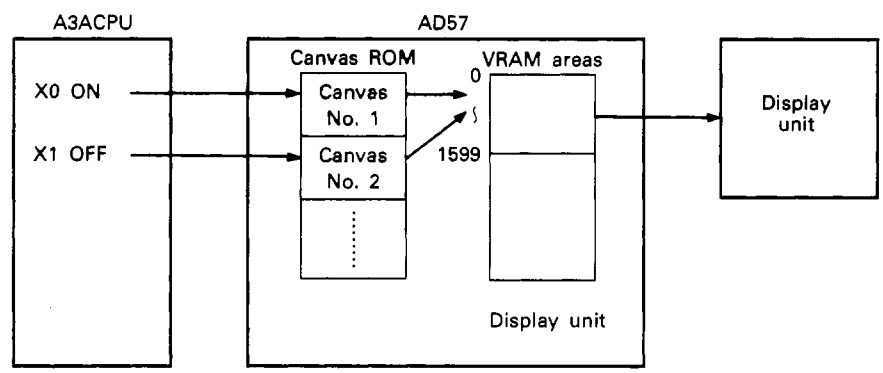
The following is an example of the program used to display canvas screens on the AD57 loaded at X/Y0C0 to 0FF.
When X000 is turned ON, canvas screen No. 1 is displayed by batch processing. When X001 is turned ON, canvas screen No. 2 is displayed by split processing.



Designation of batch/split processing is done by setting M9066 as follows.

When M9066 is OFF····· Batch processing
When M9066 is ON····· Split processing

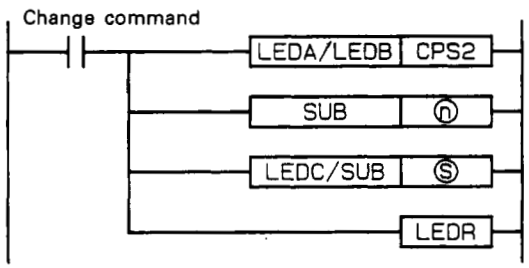
M9065 is the split processing flag and used to provide interlock so that other instructions may not be executed during split processing.
M0 is used to hold so that the CPS1 instruction may be executed till split processing is completed.



6.2.2 VRAM display address change·····CPS2

	Usable devices																			Digit specification	Number of steps	Subset	Index	Carry flag	Error flag
	Bit device							Word (16-bit) device									Constant		Pointer		Level						
	X	Y	M	L	S	B	F	T	C	D	W	R	A0	A1	Z	V	K	H	P	I	N					M9012	M9011
ⓝ																	○	○									
Ⓢ								○	○	○	○	○					○	○					20		○		○

*1: The number of steps varies with type of device used. See Section 5.2.



LEDA : Execution at ON
LEDB : Execution at leading edge

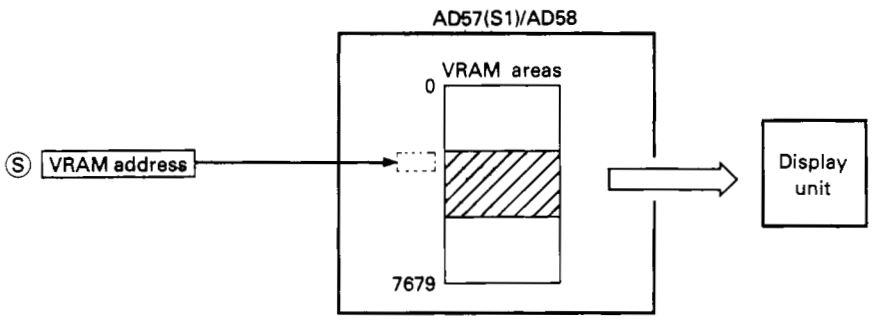
LEDC : Device number is designated
SUB : Constant is designated

Setting data

ⓝ	Head I/O number of AD57
Ⓢ	Head VRAM address where the screen data to be displayed is stored

FUNCTION

(1) The CPS2 instruction is used to change the range of VRAM areas (addresses 0 to 7679) of the AD57(S1)/AD58 designated by ⓝ, which is to be displayed, to the addresses starting with one designated by Ⓢ.



(2) Screen switching time as well as scan time of the sequence program can be shortened by switching display addresses using the CPS2 instruction instead of the CPS1 instruction. Before execution of the CPS2 instruction, canvas screens should have been transmitted to VRAM areas using the CMOV instruction.

(3) The head I/O number of the AD57(S1)/AD58 designated by ⓝ should be upper 2 digits of 3 hexadecimal digits.
Example) If the AD57(S1)/AD58 is assigned to X.Y120 to 13F, set "12_H" at ⓝ.

(4) The range of addresses to be displayed varies with preset display mode.
- CRT standard mode··· From (designated address) to (designated address + 1599)
- CRT enlarged mode··· From (designated address) to (designated address + 399)
- LCD mode ····· From (designated address) to (designated address + 799)

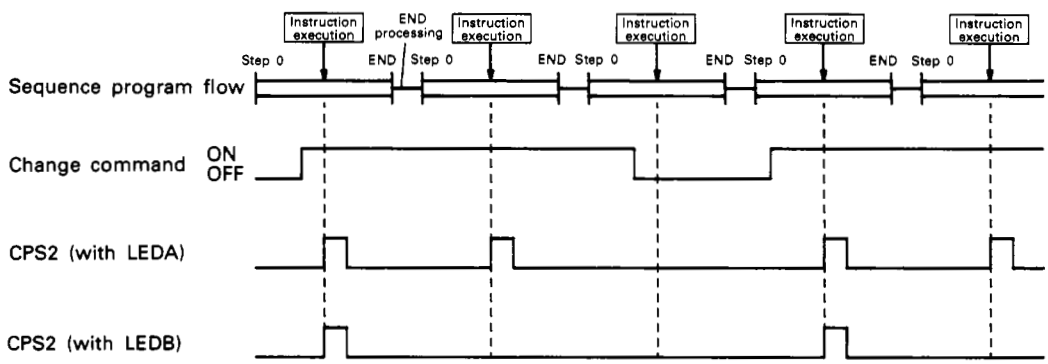
(5) The VRAM address designated by Ⓢ should be the head address of the range to be displayed.
The available range of addresses is from 0 to 7679.
If the area ranging from a designated address to address 7679 is smaller than the capacity of one screen area, the address designated by Ⓢ is automatically changed as mentioned below so that one screen area is filled with display of data.
- CRT standard mode
  If addresses starting with 6081 are designated ..... Designation is changed to address 6080.
- CRT enlarged mode
  If addresses starting with 7281 are designated ..... Designation is changed to address 7280.
- LCD mode
  If addresses starting with 6881 are designated ..... Designation is changed to address 6880.

(6) After execution of the CPS2 instruction, conditions of the display become as follows.

Item	Condition
Display mode	(no change)
Cursor line position	Line "0"
Cursor column position	Column "0"
Head VRAM address displayed	Designated address
Normal/reverse designation	Normal
Color designation	White
Cursor display	Not displayed

EXECUTION CONDITION

The CPS2 instruction is executed every scan while the change command is ON when the LEDA instruction is used. It is executed only once at the leading edge of the change command signal when the LEDB instruction is used.



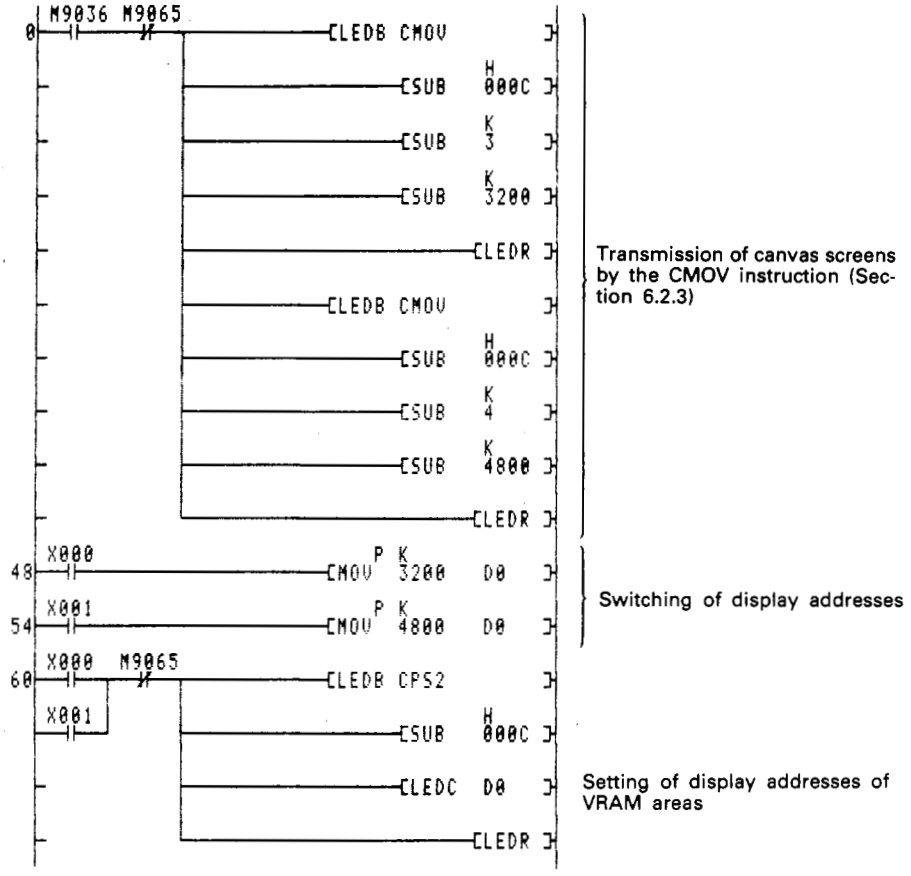
OPERATION ERROR

In the case described below, the operation error occurs and an error flag (M9011) is set.

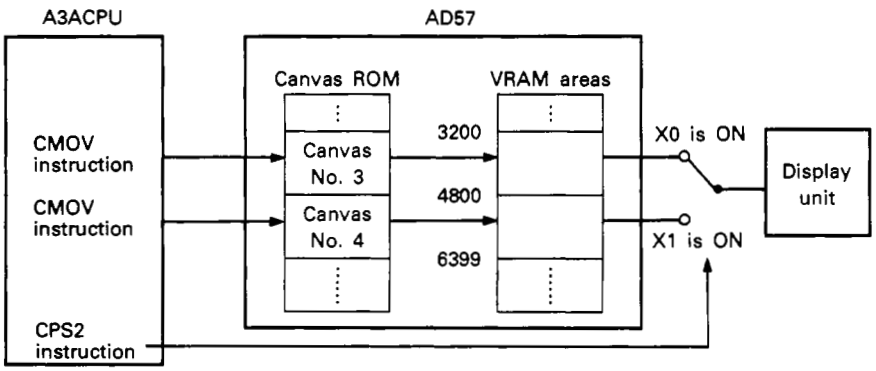
Description	Error Code	
	D9008	D9091
The VRAM area address designated by (S) is out of the range from 0 to 7679.	50	503

PROGRAM EXAMPLE

The following is an example of the program used to change display addresses of the VRAM areas of the AD57 loaded at X/Y0C0 to 0FF.
When X000 is turned ON, display data stored at addresses 3200 to 4799 in the VRAM areas is displayed. When X001 is turned ON, display data stored at addresses 4800 to 6399 in the VRAM areas is displayed.



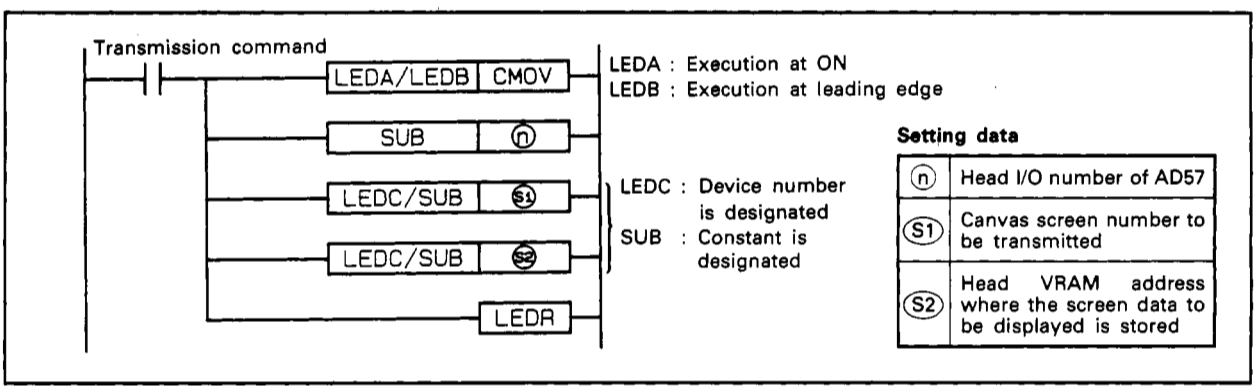
In the example above, canvas screen No. 3 is transmitted to addresses 3200 to 4799, and canvas screen No. 4 to addresses 4800 to 6399, in the VRAM areas by execution of the CMOV instruction.



6.2.3 Canvas screen transmission to VRAM areas·····CMOV

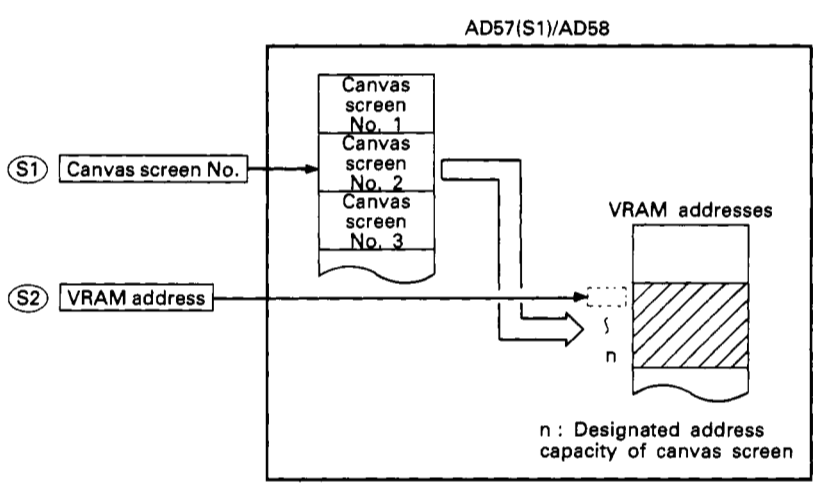
	Usable devices																			Digit specification	Number of steps	Subset	Index	Carry flag	Error flag
	Bit device							Word (16-bit) device								Constant		Pointer		Level					
	X	Y	M	L	S	B	F	T	C	D	W	R	A0	A1	Z	V	K	H	P	I	N					M9012	M9011
ⓝ																	○	○									
(S1)								○	○	○	○	○					○	○					23		○		○
(S2)								○	○	○	○	○					○	○									

*1: The number of steps varies with type of device used. See Section 5.2.



FUNCTION

(1) The CMOV instruction is used to transmit the canvas screen designated by (S1) to the addresses starting with one designated by (S2) in the VRAM areas of the AD57(S1)/AD58 designated by ⓝ.

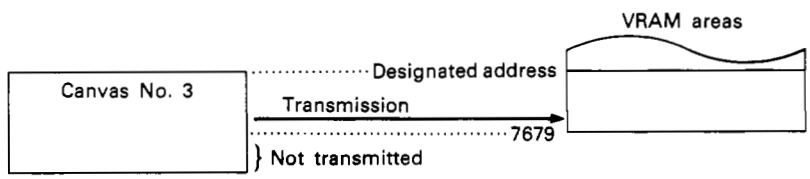


(2) The head I/O number of the AD57(S1)/AD58 designated by ⓝ should be upper 2 digits of 3 hexadecimal digits.
Example) If the AD57(S1)/AD58 is assigned to X.Y120 to 13F, set "12_H" at ⓝ.

(3) The canvas screen number to be designated by (S1) should correspond with the canvas screen number written to the canvas ROM of designated AD57(S1)/AD58.

(4) The VRAM address designated by (S2) should be the head address of the areas to be transmitted.
The available range is from 0 to 7679.
The range of addresses where transmitted data is to be stored varies with preset display mode of the canvas screen to be transmitted.
- CRT standard mode ··· From (designated address) to (designated address + 1599)
- CRT enlarged mode ··· From (designated address) to (designated address + 399)
- LCD mode ····· From (designated address) to (designated address + 799)

If the area ranging from a designated address to address 7679 is smaller than the capacity of one canvas screen area to be transmitted, only the area starting with the designated address to address 7679 is transmitted, as mentioned below.



(5) There are 2 ways of transmission of canvas screens to the VRAM areas, as mentioned below. Use special relay M9066 to switch the method of transmission.
1) Batch transmission (M9066 is OFF)
Data of designated canvas screen is transmitted in batch to the VRAM areas.
The scan time in which batch transmission is performed accordingly becomes longer than that in which transmission is not performed.

2) Split transmission (M9066 is ON)
Data of designated canvas screen is transmitted by 100 words per scan.
Scan time is not lengthened so much by the transmission operation.
However, the split transmission operation requires more processing time than the batch transmission operation.

Number of scans required for transmission processing
- In the CRT standard mode ····· 16 scans
- In the CRT enlarged mode ····· 4 scans
- In the LCD mode ····· 8 scans

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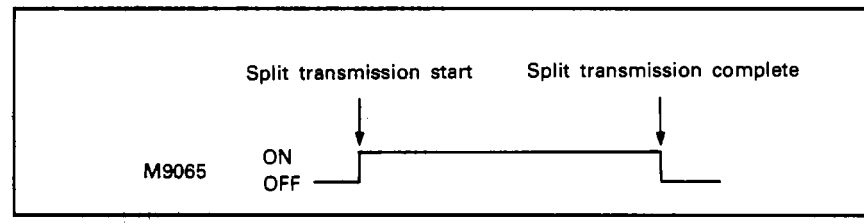
Special relay M9065 is turned ON when split transmission is started, and turned OFF when it is completed.



POINT

(1) During split transmission, execution of other instructions cannot be accepted by the AD57(S1)/AD58 to which screen data is being transmitted.
Also, execution of the following instructions cannot be accepted by other AD57(S1)/AD58.
CPS1 instruction, CMOV instruction, CLS instruction, CLV instruction

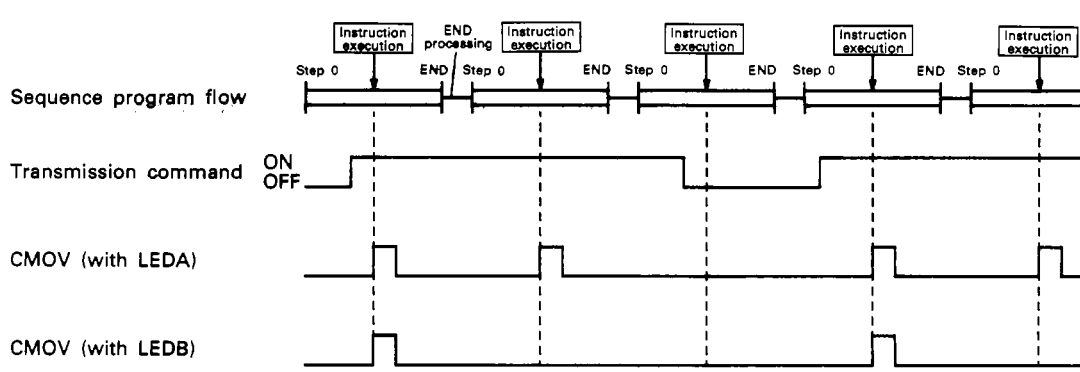
(2) The LEDB instruction cannot be used when split transmission is performed.
Display command (conditional contact) and M9066 should be held at ON during split transmission.

(6) After execution of the CMOV instruction, conditions of the display become as follows.

Item	Condition
Display mode	(no change)
Cursor line position	
Cursor column position	
Head VRAM address displayed	
Normal/reverse designation	
Color designation	
Cursor display	The cursor is not displayed only when transmission is done to the area being displayed on the display unit.

EXECUTION CONDITION

The CMOV instruction is executed every scan while the transmission command is ON when the LEDA instruction is used. It is executed only once at the leading edge of the transmission command signal when the LEDB instruction is used.



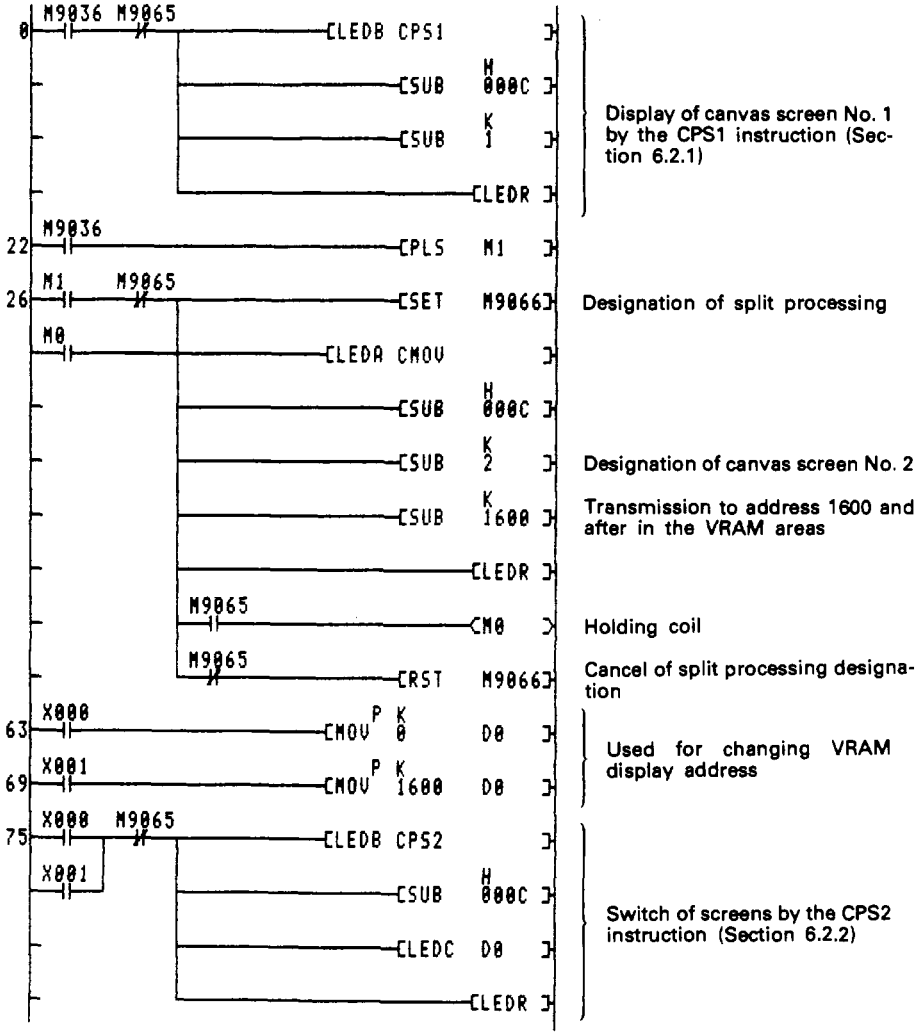
OPERATION ERROR

In the cases described below, the operation error occurs and an error flag (M9011) is set.

Description	Error Code	
	D9008	D9091
The canvas screen number designated by (S1) is out of the range from 1 to 255, or there is no canvas screen data which corresponds with the canvas screen number designated by (S1) in the canvas ROM.	50	503
The VRAM area address designated by (S2) is out of the range from 0 to 7679.		

PROGRAM EXAMPLE

The following is an example of the program used to display canvas screens and to transmit canvas screen data to the VRAM areas of the AD57 loaded at X/Y0C0 to 0FF.
Display of canvas screens and transmission of canvas screen data are performed when the PC CPU is turned on or reset.
Display of canvas screen No. 1 is executed by batch processing, and transmission of canvas screen No. 2 to addresses 1600 to 3199 is executed by split processing.



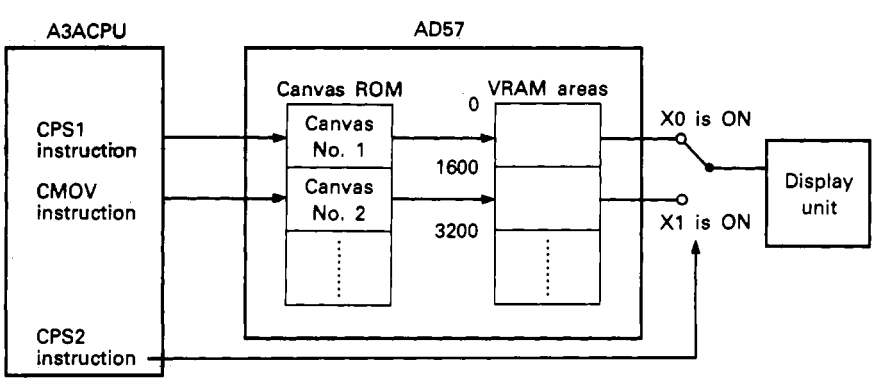
The CPS1 instruction is used to transmit canvas screen data to addresses 0 to 1599 in the VRAM areas and to display it on a display unit.
If the CMOV instruction is used, canvas screen data is transmitted to the VRAM areas, and it is not displayed on a display unit.
In the example, the canvas screen displayed by the CPS1 instruction can be switched to the canvas screen, transmitted by the CMOV instruction, by execution of the CPS2 instruction.

X0 ON ···The canvas screen displayed by the CPS1 instruction is displayed again.
X1 ON ···The canvas screen transmitted by the CMOV instruction is displayed.

Designation of batch/split processing at execution of the CPS1 and CMOV instructions is done by setting M9066 as follows.

When M9066 is OFF····· Batch processing
When M9066 is ON····· Split processing

M9065 is the split processing flag and used to provide interlock so that other instructions may not be executed during split processing.
M0 is used to hold so that the CMOV instruction may be executed till split processing is completed.

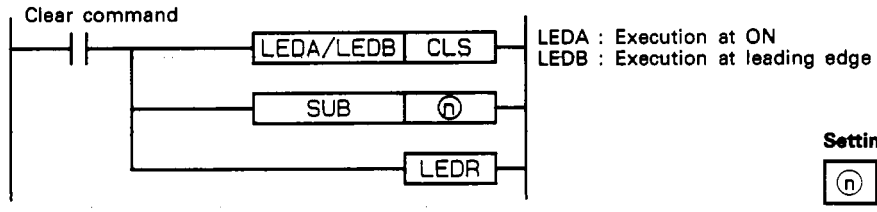


MEMO

6.2.4 Screen clear·····CLS

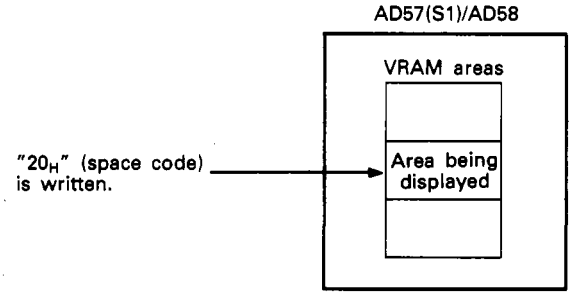
	Usable devices																				Digit specification	Number of steps	Subset	Index	Carry flag	Error flag
	Bit device							Word (16-bit) device									Constant		Pointer		Level						
	X	Y	M	L	S	B	F	T	C	D	W	R	A0	A1	Z	V	K	H	P	I	N					M9012	M9011
ⓝ																	○	○					17		○		○

*1: The number of steps varies with type of device used. See Section 5.2.



FUNCTION

(1) The CLS instruction is used to clear the VRAM areas of the AD57(S1)/AD58 designated by ⓝ to clear the screen.



(2) The head I/O number of the AD57(S1)/AD58 designated by ⓝ should be upper 2 digits of 3 hexadecimal digits.
Example) If the AD57(S1)/AD58 is assigned to X.Y120 to 13F, set "12_H" at ⓝ.

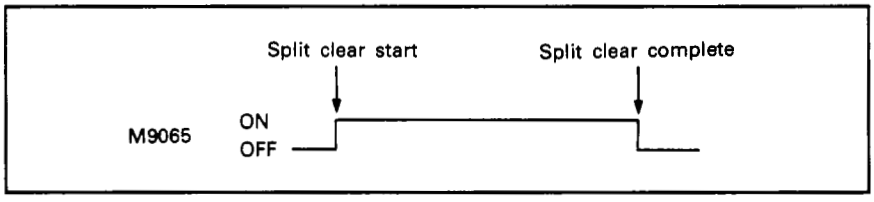
(3) There are 2 ways of clear of VRAM areas being displayed, as mentioned below. Use special relay M9066 to switch the method of processing.

1) Batch clear (M9066 is OFF)
Data of the VRAM areas being displayed is cleared in batch.
The scan time in which batch clear processing is performed accordingly becomes longer than that in which batch clear processing is not performed.

2) Split clear (M9066 is ON)
Data of the VRAM areas being displayed is cleared by 100 words per scan.
The scan time is not lengthened so much by the clear processing operation.
However, the split clear operation requires more processing time than the batch clear operation.

(Number of scans required for transmission processing
In the CRT standard mode ····· 16 scans
In the CRT enlarged mode ····· 4 scans
In the LCD mode ····· 8 scans)

Special relay M9065 is turned ON when the split clear operation is started, and turned OFF when it is completed.



POINT

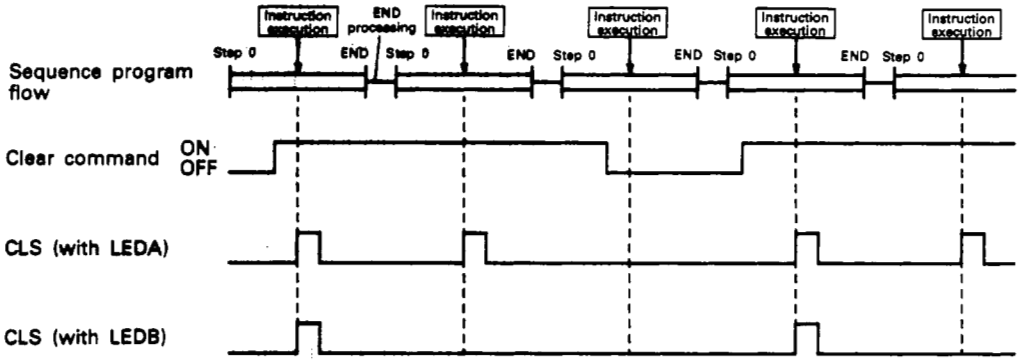
(1) During the split clear operation, execution of other instructions cannot be accepted by the AD57(S1)/AD58 of which VRAM area data is being cleared.
Also, execution of the following instructions cannot be accepted by other AD57(S1)/AD58 modules.
CPS1 instruction, CMOV instruction, CLS instruction, CLV instruction

(2) The LEDB instruction cannot be used when the split clear operation is performed.
The clear command (conditional contact) and M9066 should be held at ON during the split clear operation.

(4) After execution of the CLS instruction, conditions of the display become as follows.

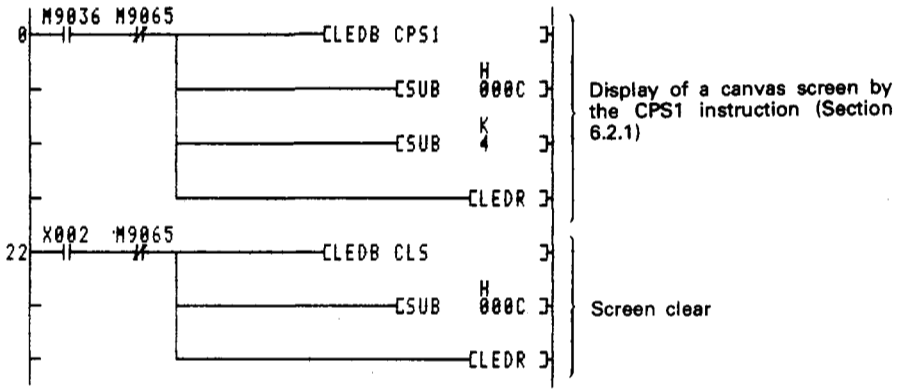
Item	Condition
Display mode	(no change)
Cursor line position	Line "0"
Cursor column position	Column "0"
Head VRAM address displayed	(no change)
Normal/reverse designation	Normal
Color designation	White
Cursor display	Not displayed

EXECUTION CONDITION The CLS instruction is executed every scan while the clear command is ON when the LEDA instruction is used. It is executed only once at the leading edge of the clear command signal when the LEDB instruction is used.

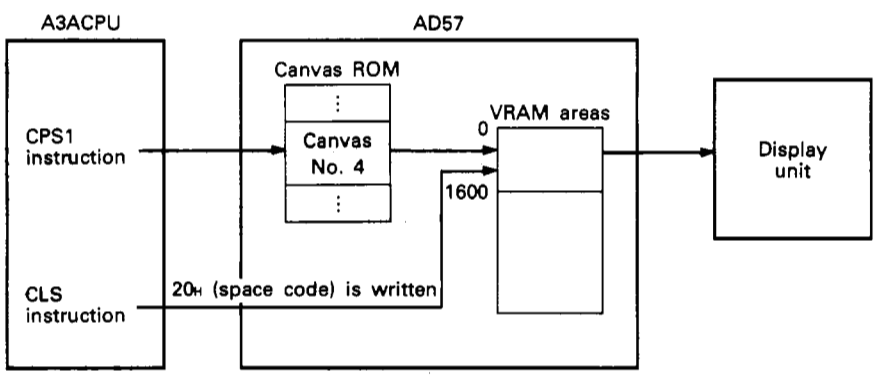


PROGRAM EXAMPLE

The following is an example of the program used to clear data displayed on a display unit which is connected to the AD57 loaded at X/Y0C0 to 0FF.
Data on the screen is cleared by turning on X002.



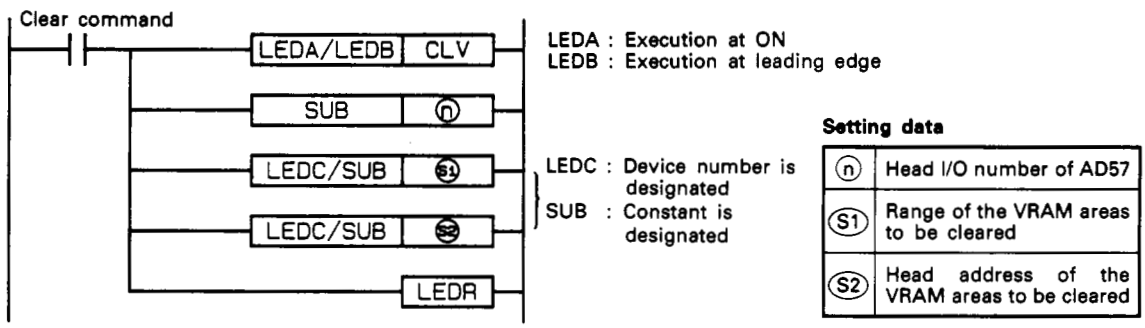
In the program example above, the CPS1 instruction is used to display canvas screen No. 4 when the PC CPU is turned on or reset.



6.2.5 VRAM area clear·····CLV

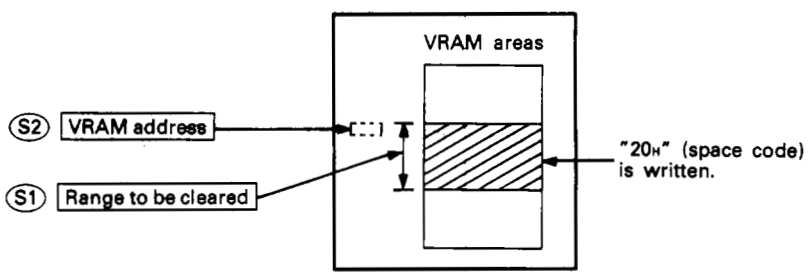
	Usable devices																			Number of steps	Digit specification	Subset	Index	Carry flag	Error flag
	Bit device							Word (16-bit) device									Constant		Pointer		Level					
	X	Y	M	L	S	B	F	T	C	D	W	R	A0	A1	Z	V	K	H	P	I	N					M9012	M9011
ⓝ																	○	○									
(S1)								○	○	○	○	○					○	○					23		○		○
(S2)								○	○	○	○	○					○	○									

*1: The number of steps varies with type of device used. See Section 5.2.



FUNCTION

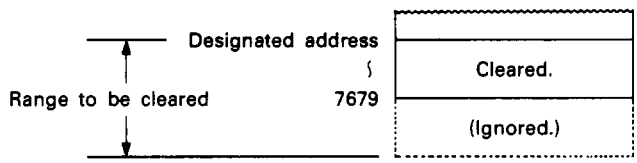
(1) The CLV instruction is used to clear the VRAM areas designated by (S1) starting with the address designated by (S2) with respect to the AD57(S1)/AD58 designated by ⓝ.



(2) The head I/O number of the AD57(S1)/AD58 designated by ⓝ should be upper 2 digits of 3 hexadecimal digits.
Example) If the AD57(S1)/AD58 is assigned to X.Y120 to 13F, set "12_H" at ⓝ.

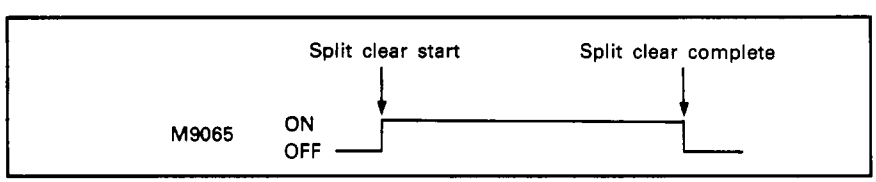
(3) The range to be cleared designated by (S1) should be set within the range of "0" to "3" as mentioned below.
0, 3 or 5·····From (designated address) to (designated address + 1599)
1·····From (designated address) to (designated address + 399)
2·····From (designated address) to (designated address + 799)

(4) The VRAM address designated by (S2) should be the head address of the areas to be cleared.
The available range of setting is from 1 to 7679.
If the area ranging from a designated address to address 7679 is smaller than the areas to be cleared designated by (S1), only the area starting with the designated address to address 7679 is cleared, as mentioned below.



(5) There are 2 ways of clearing of VRAM areas, as mentioned below. Use special relay M9066 to switch the method of processing.
1) Batch clear (M9066 is OFF)
Data of designated VRAM areas is cleared in batch.
The scan time in which batch clear processing is performed accordingly becomes longer than that in which batch clear processing is not performed.

2) Split clear (M9066 is ON)
Data of designated VRAM areas is cleared by 100 words per scan.
The scan time is not lengthened so much by the clear processing operation.
However, the split clear operation requires more processing time than the batch clear operation.
(Number of scans required for transmission processing
In the CRT standard mode ····· 16 scans
In the CRT enlarged mode ····· 4 scans
In the LCD mode ····· 8 scans)
Special relay M9065 is turned ON when the split clear operation is started, and turned OFF when it is completed.



POINT

(1) During the split clear operation, execution of other instructions cannot be accepted by the AD57(S1)/AD58 of which VRAM area data is being cleared.
Also, execution of the following instructions cannot be accepted by other AD57(S1)/AD58 modules.
CPS1 instruction, CMOV instruction, CLS instruction, CLV instruction

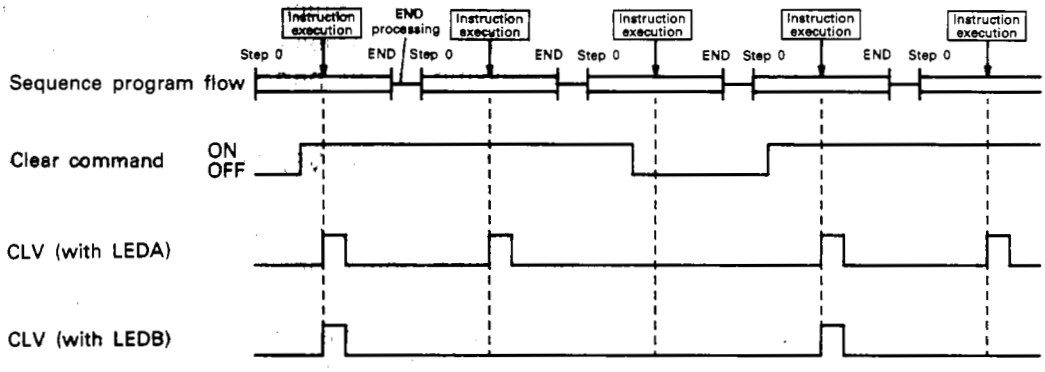
(2) The LEDB instruction cannot be used when the split clear operation is performed.
The clear command (conditional contact) and M9066 should be held at ON during the split clear operation.

(6) After execution of the CLV instruction, conditions of the display become as follows.

Item	Condition
Display mode	(no change)
Cursor line position	
Cursor column position	
Head VRAM address displayed	
Normal/reverse designation	
Color designation	
Cursor display	Not displayed only when the areas displayed on a display unit are cleared.

EXECUTION CONDITION

The CLV instruction is executed every scan while the clear command is ON when the LEDA instruction is used. It is executed only once at the leading edge of the clear command signal when the LEDB instruction is used.



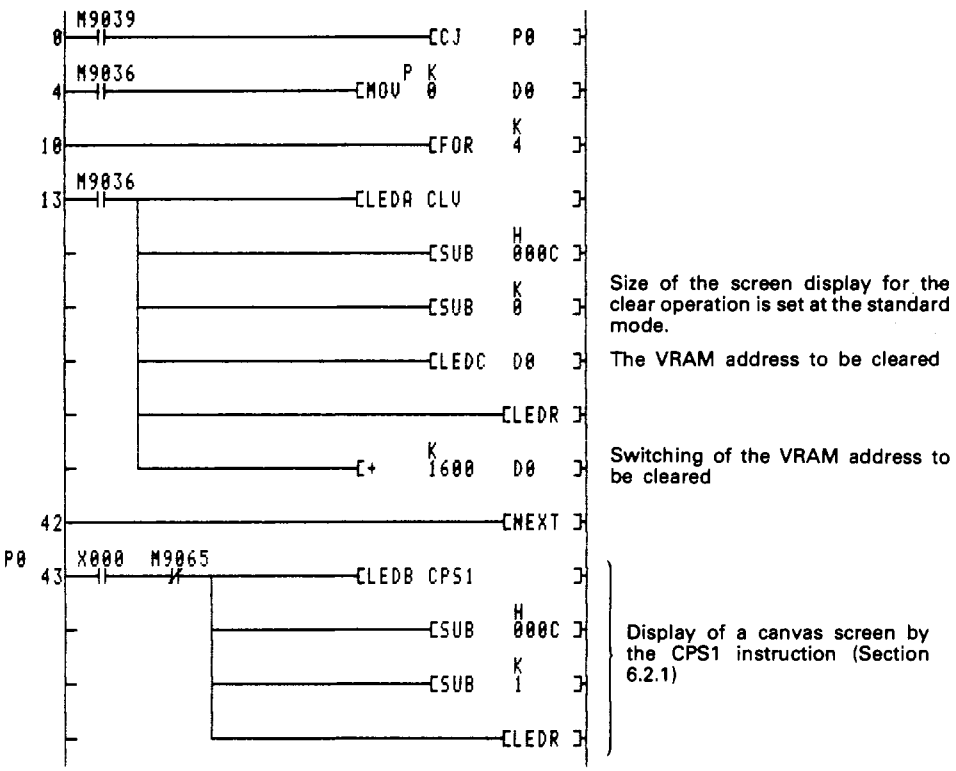
OPERATION ERROR

In the cases described below, the operation error occurs and an error flag (M9011) is set.

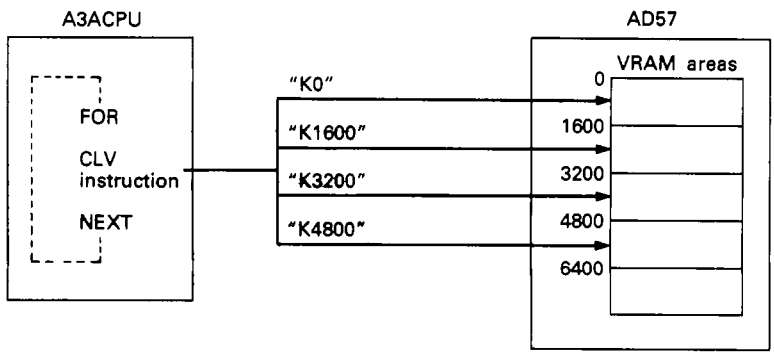
Description	Error Code	
	D9008	D9091
The display mode setting data designated by (S1) is out of the range from 0 to 3 and 5.	50	503
The VRAM area address designated by (S2) is out of the range from 0 to 7679.		

PROGRAM EXAMPLE

The following is an example of the program used to clear data of the VRAM areas of the AD57 loaded at X/Y0C0 to 0FF.
Data of addresses 0 to 6399 of the VRAM areas is cleared by batch processing.
Clearing of the VRAM area data is performed only once when the PC CPU is turned on or reset.



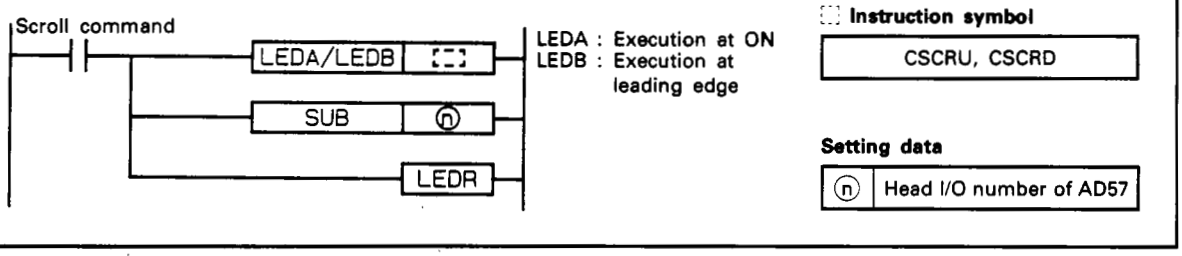
The VRAM area clear operation by the CLV instruction is performed according to the size of the screen display in the display mode currently set. In the program example, the display mode is considered to be set at the CRT standard mode.
Data in the VRAM areas from address 0 to 6399 is cleared 4 times in units of 1600 addresses per one time.



6.2.6 Screen scroll·····CSCRU, CSCRD

	Usable devices																				Digit specification	Number of steps	Subset	Index	Carry flag	Error flag
	Bit device							Word (16-bit) device									Constant		Pointer		Level						
	X	Y	M	L	S	B	F	T	C	D	W	R	A0	A1	Z	V	K	H	P	I	N					M9012	M9011
ⓝ																	○	○					17		○		○

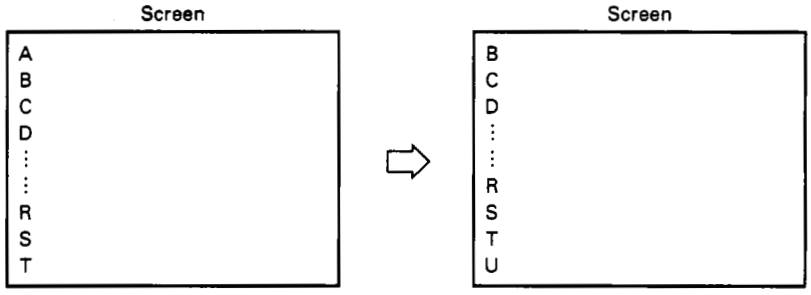
*1: The number of steps varies with type of device used. See Section 5.2.



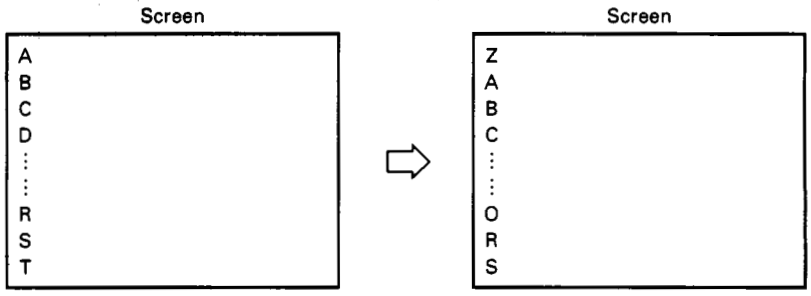
FUNCTION

(1) The CSCRU and CSCRD instructions are used to scroll up and down the screen one line at a time on the display unit connected to the AD57(S1)/AD58 designated by ⓝ.
CSCRU instruction ····· Scroll up
CSCRD instruction····· Scroll down

Scroll up

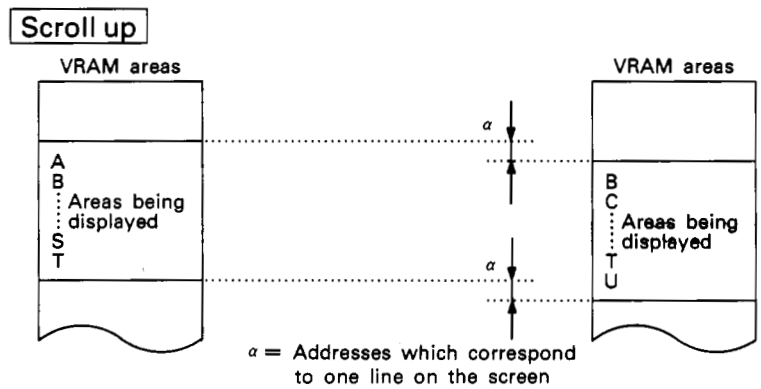


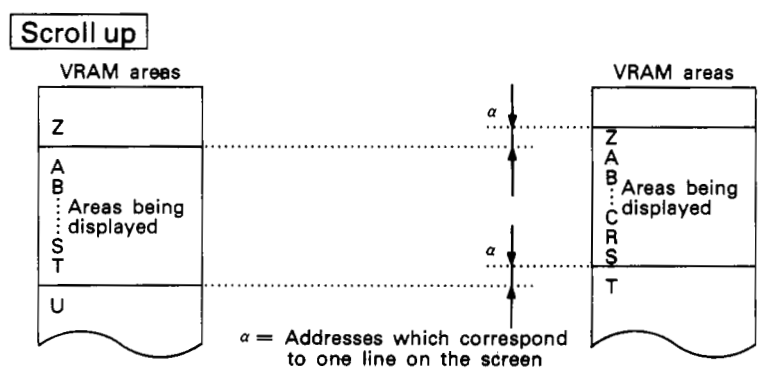
Scroll down



(2) The head I/O number of the AD57(S1)/AD58 designated by ⓝ should be upper 2 digits of 3 hexadecimal digits.
Example) If the AD57(S1)/AD58 is assigned to X.Y120 to 13F, set "12_H" at ⓝ.

(3) The scroll up/down operations are performed by adding or subtracting the address data mentioned below to or from the address of the VRAM areas being displayed.
In the CRT standard mode ····· 80 addresses
In the CRT enlarged mode ····· 40 addresses
In the LCD mode ····· 80 addresses





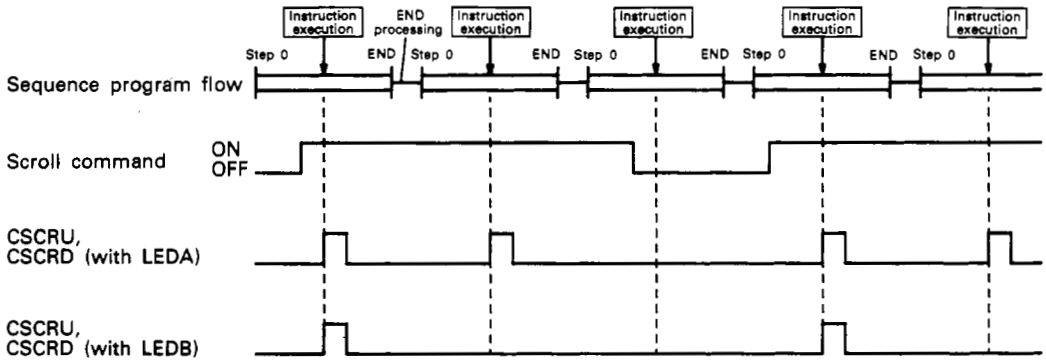
(4) The operation error occurs when the head of the VRAM area addresses being displayed exceeds the address mentioned below in the scroll up operation. The operation error occurs also when the head address exceeds address 0 in the scroll down operation.
In the CRT standard mode ····· Address 6080
In the CRT enlarged mode ····· Address 7280
In the LCD mode ····· Address 6880
The CSCRU and CSCRD instructions should be used in the sequence program so that they may be executed when the head address is within the ranges mentioned below.
In the CRT standard mode ····· Addresses 80 to 6000
In the CRT enlarged mode ····· Addresses 40 to 7240
In the LCD mode ····· Addresses 80 to 6800

(5) After execution of the CSCRU and CSCRD instructions, conditions of the display become as follows.

Item	Condition
Display mode	(no change)
Cursor line position	
Cursor column position	
Head VRAM address displayed	CSCRU instruction: Addresses for addition of one line CSCRD instruction: Addresses for subtraction of one line
Normal/reverse designation	(no change)
Color designation	
Cursor display	

EXECUTION CONDITION

The CSCRU and CSCRD instructions are executed every scan while the scroll command is ON when the LEDA instruction is used. It is executed only once at the leading edge of the scroll command signal when the LEDB instruction is used.



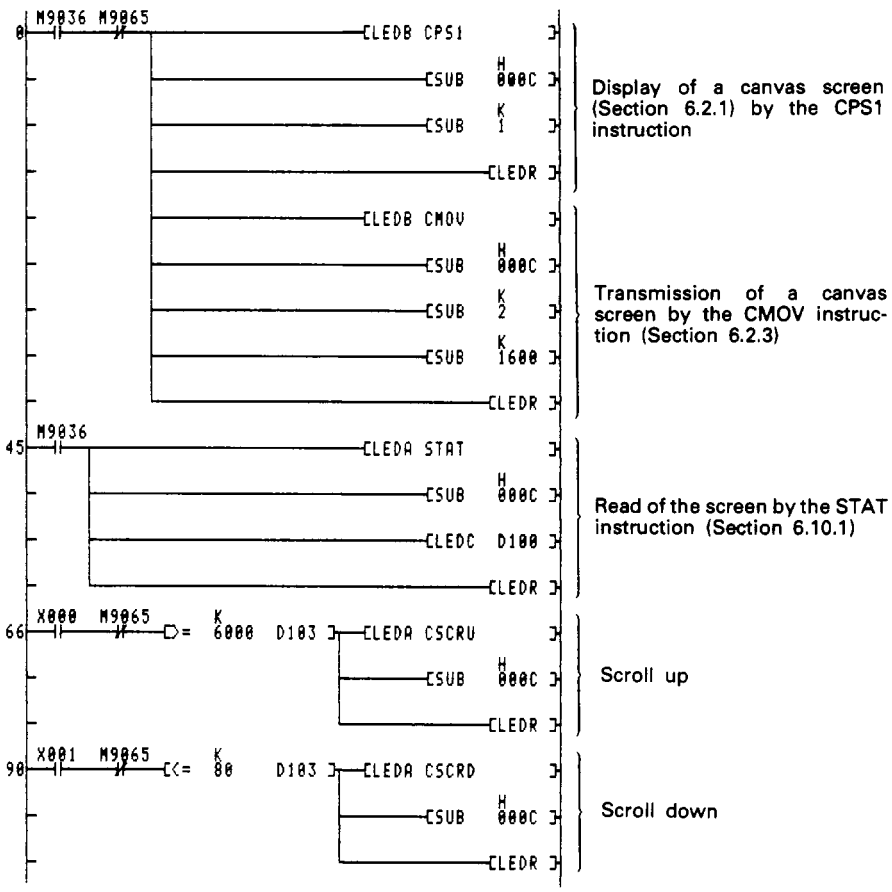
OPERATION ERROR

In the cases described below, the operation error occurs and an error flag (M9011) is set.

Description	Error Code D9008	Error Code D9091
The head of the VRAM area addresses being displayed exceeds the values mentioned below in the scroll up (CSCRU) operation. In the CRT standard mode ····· Address 6080 In the CRT enlarged mode ····· Address 7280 In the LCD mode ····· Address 6880	50	503
The head of the VRAM area addresses being displayed exceeds 0 in the scroll down (CSCRD) operation.		

PROGRAM EXAMPLE

The following is an example of the program used to scroll up/down the screen one line at a time on a display unit connected to the AD57 loaded at X/Y0C0 to 0FF.
Scrolling up is performed by turning on X0. Scrolling down is performed by turning on X1.



The STAT instruction (Section 6.10.1) is used to read the display condition of the screen. In this example, the STAT instruction is used to read the head of the VRAM addresses being displayed and to check the range of the displayed areas if scrolling up or down is possible by execution of the CSCRU or CSCRD instruction.
Since the scroll up/down operations are executed by changing the addresses of the VRAM areas being displayed for one line at a time, execution of scrolling up/down exceeding specified VRAM areas will result in an operation error.

MEMO

6.3 Cursor Control Instructions

The cursor control instructions are used to turn on and off display of the cursor and to move the cursor on the screen.

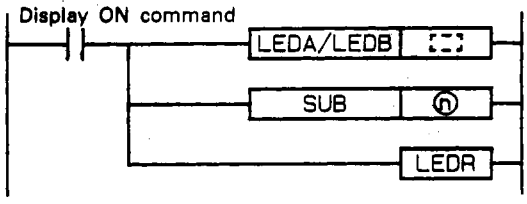
Cursor control is executed using the instructions mentioned below.

Category	Instruction Name	Description
Cursor display ON	CON1	The one-character cursor is displayed at current cursor position.
	CON2	The two-character cursor is displayed at current cursor position.
Cursor display OFF	COFF	Display of the cursor is turned off.
Cursor movement	LOCATE	The cursor on the display is moved.

6.3.1 Cursor display ON·····CON1, CON2

	Usable devices																				Digit specification	Number of steps	Subset	Index	Carry flag	Error flag
	Bit device							Word (16-bit) device								Constant		Pointer		Level						
	X	Y	M	L	S	B	F	T	C	D	W	R	A0	A1	Z	V	K	H	P	I	N					M9012	M9011
ⓝ																	○	○					17		○		○

*1: The number of steps varies with type of device used. See Section 5.2.



FUNCTION

(1) The CON1 and CON2 instructions are used to display the cursor at current cursor position on the screen of a display unit connected to the AD57(S1)/AD58 designated by ⓝ.
CON1 instruction ····· Displays the one-character cursor (8×16 dots).
CON2 instruction ····· Displays the two-character cursor (16×16 dots).

(2) The head I/O number of the AD57(S1)/AD58 designated by ⓝ should be upper 2 digits of 3 hexadecimal digits.
Example) If the AD57(S1)/AD58 is assigned to X.Y120 to 13F, set "12_H" at ⓝ.

(3) Any character displayed at the cursor position is reversed when the cursor is displayed.

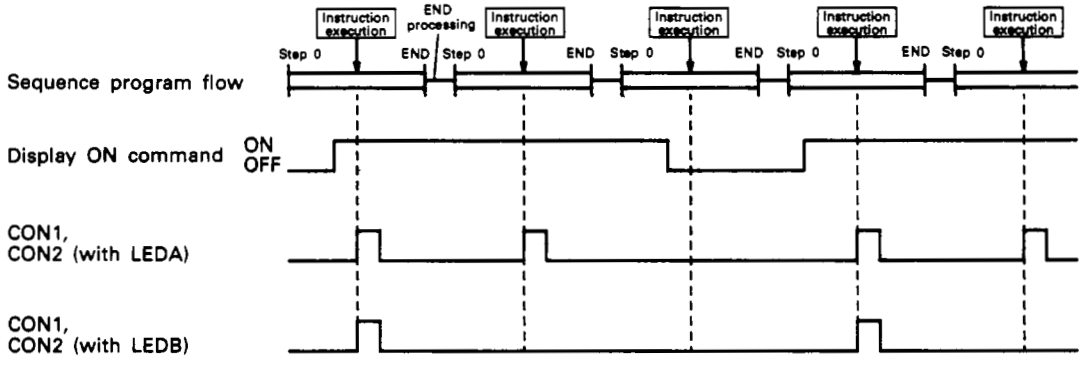
(4) When the two-character cursor, being displayed by execution of the CON2 instruction, is moved to 79th column on any line on the screen, the cursor changes to the one-character size. When the cursor is moved to any other column, it returns to the two-character size.

(5) Refer to the description of instruction for moving or turning off the cursor.
Cursor movement ····· LOCATE instruction
Cursor display off ····· COFF instruction

(6) After execution of the CON1 and CON2 instructions, conditions of the display become as follows.

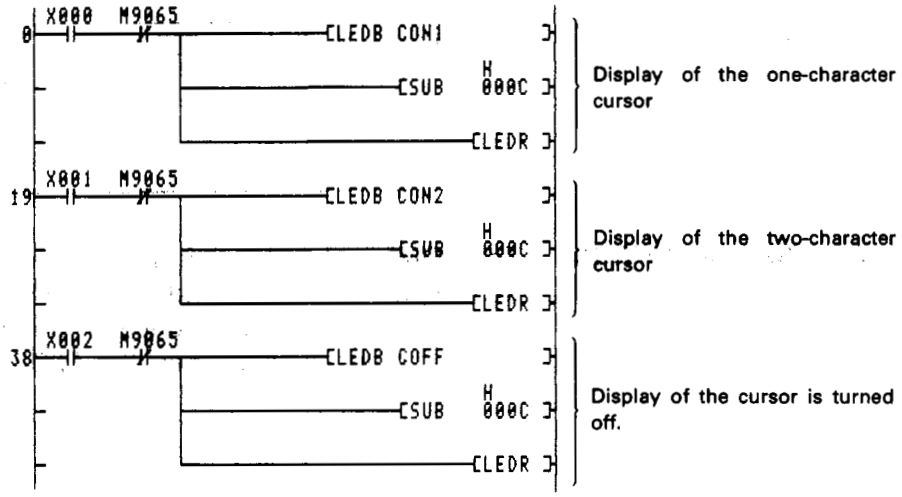
Item	Condition
Display mode	(no change)
Cursor line position	
Cursor column position	
Head VRAM address displayed	
Normal/reverse designation	
Color designation	
Cursor display	CON1 instruction The one-character cursor is displayed. CON2 instruction The two-character cursor is displayed.

EXECUTION CONDITION The CON1 and CON2 instructions are executed every scan while the display ON command is ON when the LEDA instruction is used. It is executed only once at the leading edge of the display ON command signal when the LEDB instruction is used.



PROGRAM EXAMPLE

The following is an example of the program used to turn on/off the cursor on the screen of a display unit connected to the AD57 loaded at X/Y0C0 to 0FF.
The one-character cursor is displayed by turning on X0. The two-character cursor is displayed by turning on X1.
Display of the cursor is turned off by turning on X2.



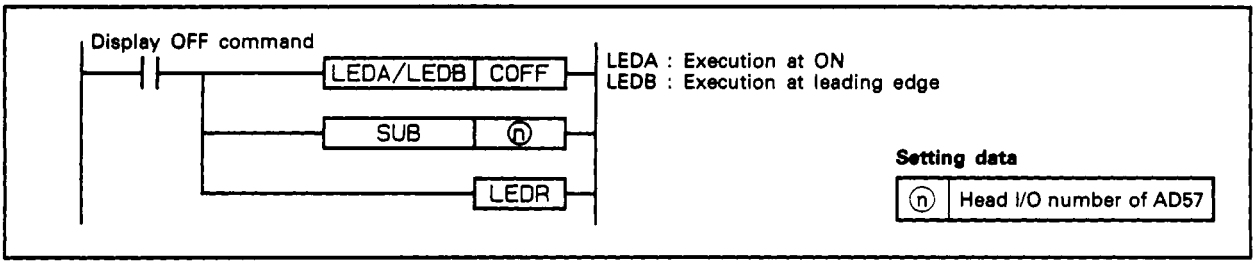
By execution of the CON1 instruction, the one-character cursor is displayed at current cursor position. By execution of the CON2 instruction, the two-character cursor is displayed.
By execution of the COFF instruction, display of the cursor on the screen is turned off.

MEMO

6.3.2 Cursor display OFF·····COFF

	Usable devices																				Digit specification	Number of steps	Subset	Index	Carry flag	Error flag
	Bit device							Word (16-bit) device								Constant		Pointer		Level						
	X	Y	M	L	S	B	F	T	C	D	W	R	A0	A1	Z	V	K	H	P	I	N				M9012	M9011
ⓝ																	○	○					17		○		○

*1: The number of steps varies with type of device used. See Section 5.2.



FUNCTION

(1) The COFF instruction is used to turn off display of the cursor on the screen of a display unit connected to the AD57(S1)/AD58 designated by ⓝ.

(2) The head I/O number of the AD57(S1)/AD58 designated by ⓝ should be upper 2 digits of 3 hexadecimal digits.
Example) If the AD57(S1)/AD58 is assigned to X.Y120 to 13F, set "12_H" at ⓝ.

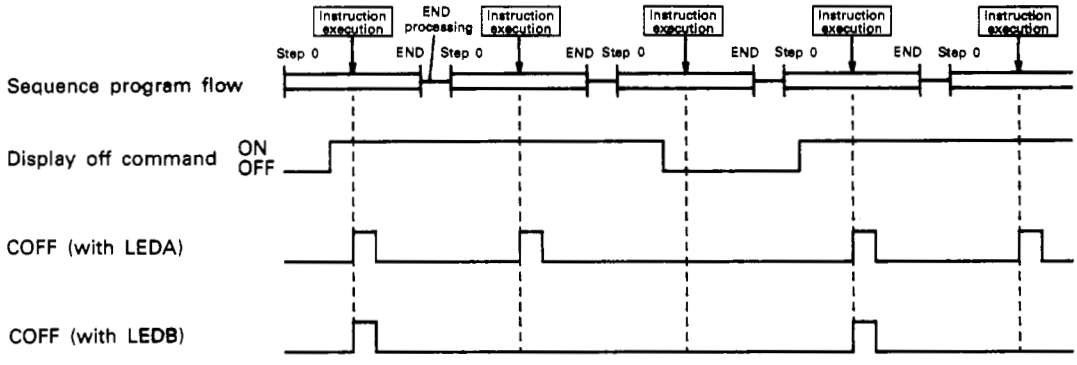
(3) Refer to the description of instruction for moving or turning on the cursor.
Cursor display on ····· CON1 and CON2 instructions
Cursor movement ····· LOCATE instruction

(4) After execution of the COFF instruction, conditions of the display become as follows.

Item	Condition
Display mode	(no change)
Cursor line position	
Cursor column position	
Head VRAM address displayed	
Normal/reverse designation	
Color designation	
Cursor display	Not displayed

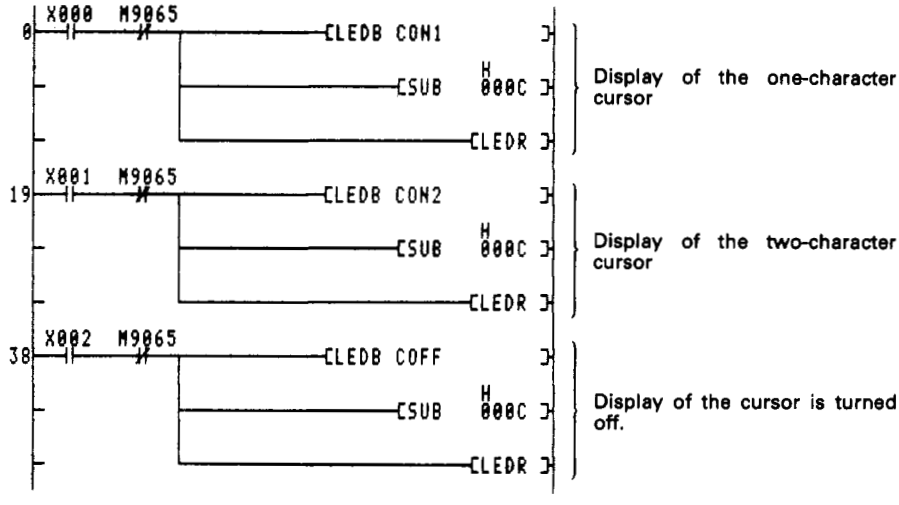
EXECUTION CONDITION

The COFF instruction is executed every scan while the display off command is ON when the LEDA instruction is used. It is executed only once at the leading edge of the display off command signal when the LEDB instruction is used.



PROGRAM EXAMPLE

The following is an example of the program used to turn on/off the cursor on the screen of a display unit connected to the AD57 loaded at X/Y0C0 to 0FF.
The one-character cursor is displayed by turning on X0. The two-character cursor is displayed by turning on X1.
Display of the cursor is turned off by turning on X2.



By execution of the CON1 instruction, the one-character cursor is displayed at current cursor position. By execution of the CON2 instruction, the two-character cursor is displayed.
By execution of the COFF instruction, display of the cursor on the screen is turned off.

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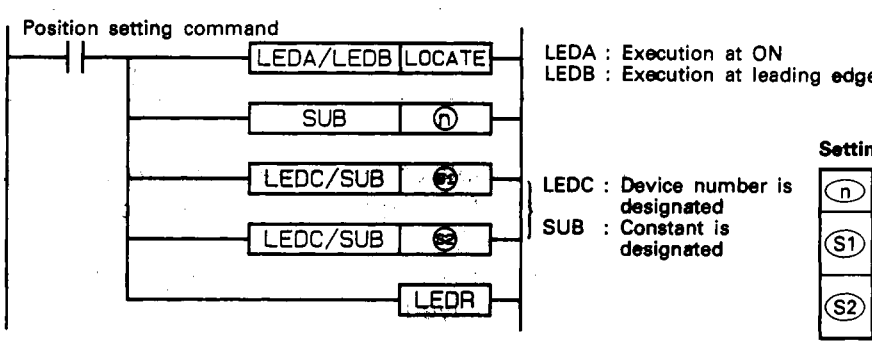
6.3.3 Cursor position setting·····LOCATE

	Usable devices																				Digit specification	Number of steps	Subset	Index	Carry flag	Error flag
	Bit device							Word (16-bit) device									Constant		Pointer		Level						
	X	Y	M	L	S	B	F	T	C	D	W	R	A0	A1	Z	V	K	H	P	I	N					M9012	M9011
ⓝ																	○	○									
(S1)								○	○	○	○	○					○	○					23		○		○
(S2)								○	○	○	○	○					○	○									

*1: The number of steps varies with type of device used. See Section 5.2.

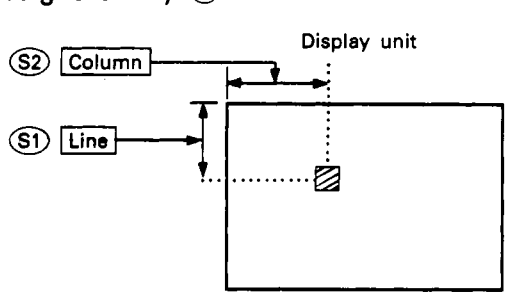


Setting data

ⓝ	Head I/O number of AD57
(S1)	Destination line of cursor movement
(S2)	Destination column of cursor movement

FUNCTION

(1) The LOCATE instruction is used to move the cursor to the line designated by (S1) and to the column designated by (S2) on the screen of a display unit connected to the AD57(S1)/AD58 designated by ⓝ.



(2) The head I/O number of the AD57(S1)/AD58 designated by ⓝ should be upper 2 digits of 3 hexadecimal digits.
Example) If the AD57(S1)/AD58 is assigned to X.Y120 to 13F, set "12_H" at ⓝ.

(3) The range available for setting destination lines and columns at (S1) and (S2) varies with the display mode being used as mentioned below.

Display Mode	Line ((S1))	Column ((S2))
CRT standard mode (0 or 3)	0~19	0~79
CRT enlarged mode (1)	0~ 9	0~39
LCD mode (2)	0~ 9	0~79

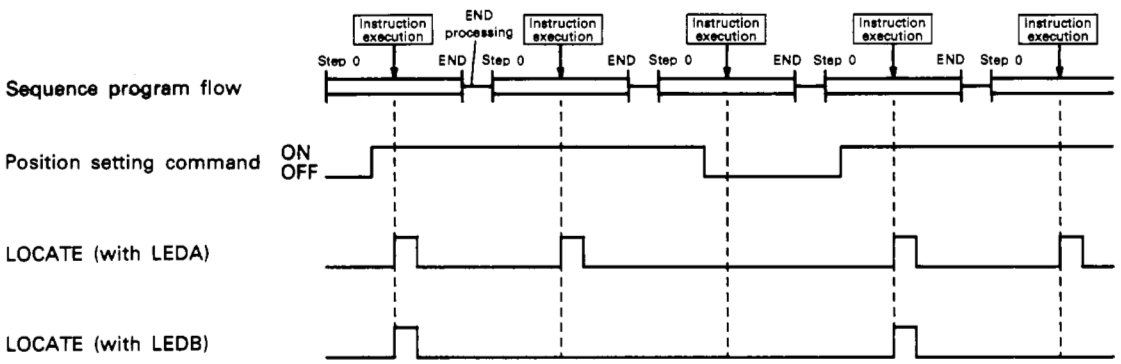
(4) If the LOCATE instruction is used when display of the cursor is turned off, only the cursor position is moved.

(5) After execution of the LOCATE instruction, conditions of the display become as follows.

Item	Condition
Display mode	(no change)
Cursor line position	Designated line
Cursor column position	Designated column
Head VRAM address displayed	(no change)
Normal/reverse designation	
Color designation	
Cursor display	

EXECUTION CONDITION

The LOCATE instruction is executed every scan while the position setting command is ON when the LEDA instruction is used. It is executed only once at the leading edge of the position setting command signal when the LEDB instruction is used.



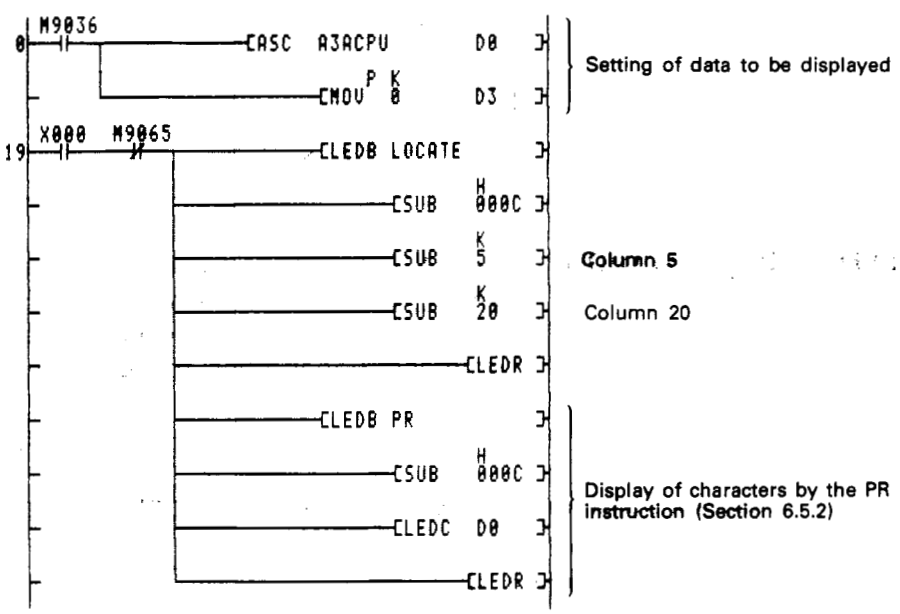
OPERATION ERROR

In the cases described below, the operation error occurs and an error flag (M9011) is set.

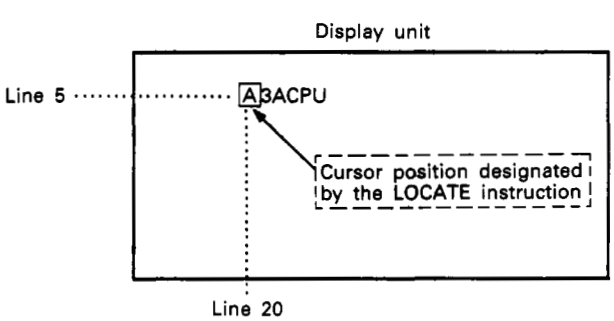
Description	Error Code D9008	Error Code D9091
The line position designated by (S1) is out of the ranges mentioned below. In the CRT standard mode ····· 0 to 19 In the CRT enlarged mode ····· 0 to 9 In the LCD mode ····· 0 to 9	50	503
The column position designated by (S2) is out of the ranges mentioned below. In the CRT standard mode ····· 0 to 79 In the CRT enlarged mode ····· 0 to 39 In the LCD mode ····· 0 to 79		

PROGRAM EXAMPLE

The following is an example of the program used to move the cursor on the screen of a display unit connected to the AD57 loaded at X/Y0C0 to 0FF.
By turning on X000, the cursor on the screen is moved to column 20 on line 5.



In this example, characters "A3ACPU" are displayed by execution of the ASCII character display instruction (PR) after cursor movement.



6.4 Display Condition Setting Instructions

The display condition setting instructions are used to change color or perform normal/reverse switching of characters to be or being displayed.
Using the display condition setting instructions, color designation and normal/reverse switching of character display can be easily performed.

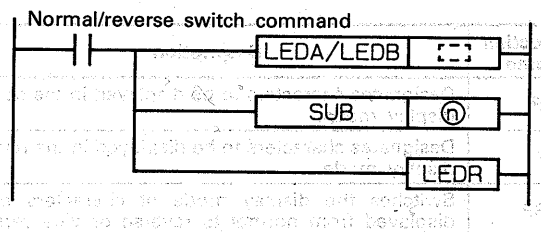
Display condition setting is executed using the instructions mentioned below.

Category	Instruction Name	Description
Normal/reverse switching	CNOR	Designates characters to be displayed in the normal display mode.
	CREV	Designates characters to be displayed in the reverse display mode.
	CRDSP	Switches the display mode of characters being displayed from normal to reverse or vice versa.
	CRDSPV	Switches the display mode of the characters stored at designated addresses in the VRAM areas from normal to reverse or vice versa.
Color designation	COLOR	Designates color of characters to be displayed.
	CCDSP	Changes color of characters being displayed.
	CCDSPV	Changes color of the characters stored at designated addresses in the VRAM areas.

6.4.1 Normal/reverse display of characters·····CNOR, CREV

	Usable devices																			Digit specification	Number of steps	Subset	Index	Carry flag	Error flag
	Bit device							Word (16-bit) device								Constant		Pointer		Level					
	X	Y	M	L	S	B	F	T	C	D	W	R	A0	A1	Z	V	K	H	P	I	N					M9012	M9011
ⓝ																	○	○					17		○		○

*1: The number of steps varies with type of device used. See Section 5.2.



Instruction symbols in ⬚

CNOR, CREV

Setting data

ⓝ	Head I/O number of AD57

FUNCTION

(1) The CNOR and CREV instructions are used to designate the normal or reverse display of characters to be displayed on the screen of a display unit connected to the AD57(S1)/AD58 designated by ⓝ.

CNOR·····Normal display (ABC)
CREV·····Reverse display (ABC)

(2) The head I/O number of the AD57(S1)/AD58 designated by ⓝ should be upper 2 digits of 3 hexadecimal digits.

Example) If the AD57(S1)/AD58 is assigned to X.Y120 to 13F, set "12_H" at ⓝ.

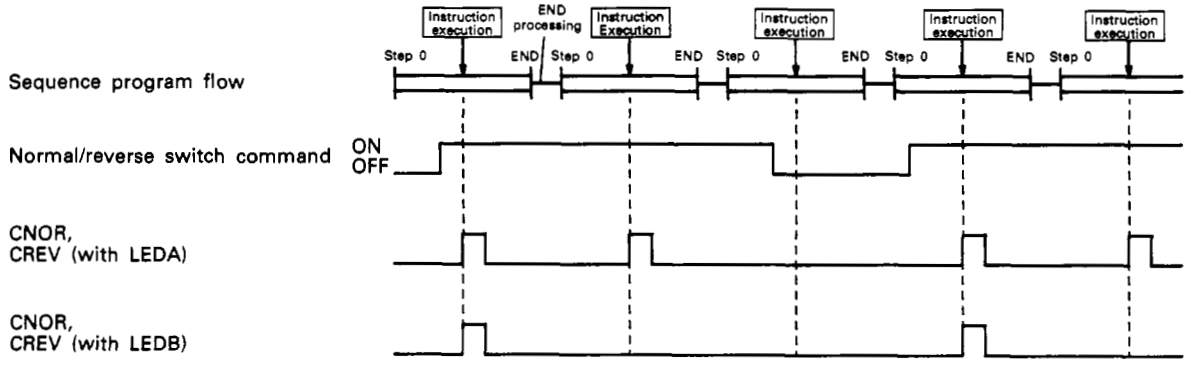
(3) The normal or reverse display mode of characters automatically sets to the normal display mode when the following instructions are executed.

CPS1
CPS2
CLS

(4) After execution of the CNOR or CREV instruction, conditions of the display become as follows.

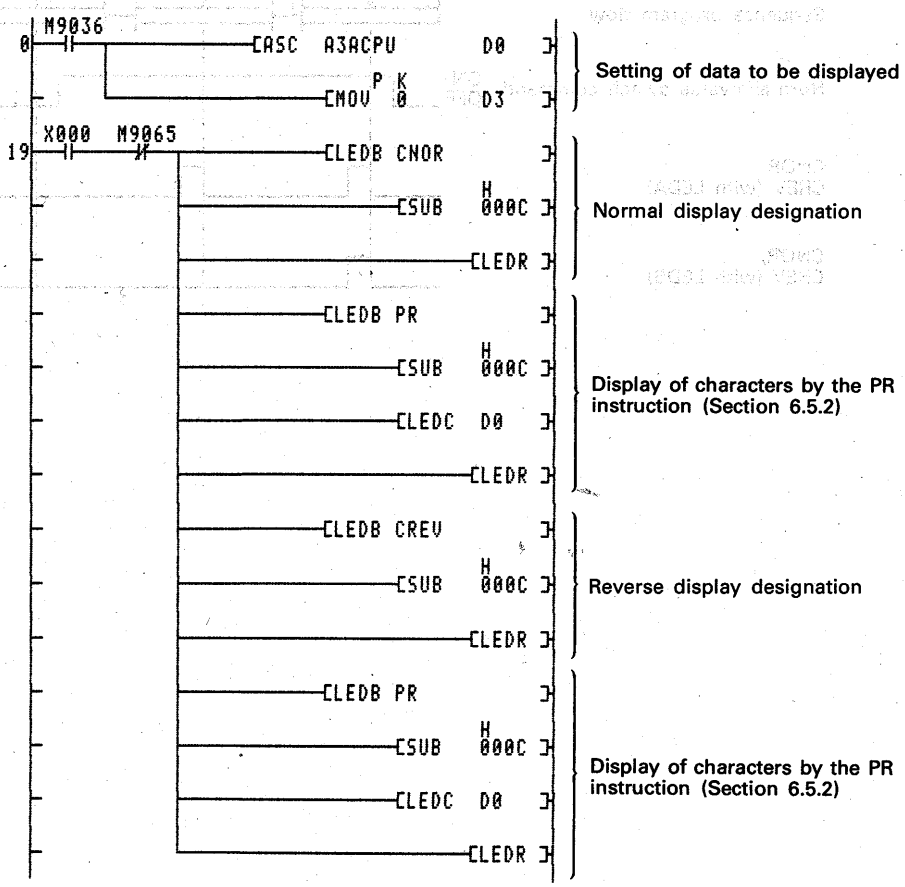
Item	Condition
Display mode	(no change)
Cursor line position	
Cursor column position	
Head VRAM address displayed	
Normal/reverse designation	CNOR Normal display CREV Reverse display
Color designation	(no change)
Cursor display	

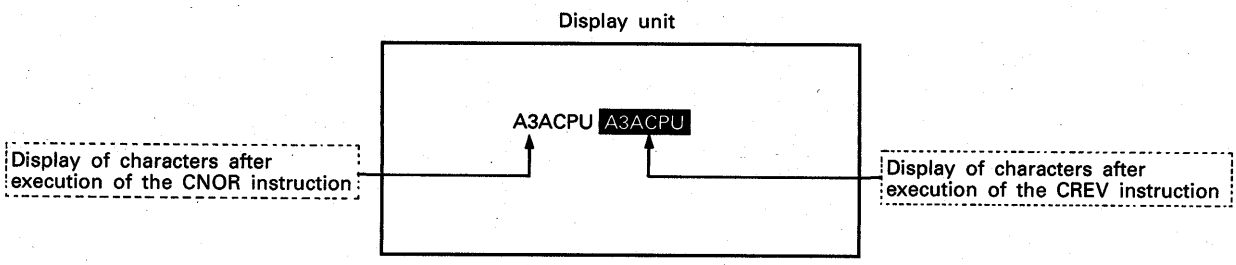
EXECUTION CONDITION The CNOR and CREV instructions are executed every scan while the normal/reverse switch command is ON when the LEDA instruction is used. It is executed only once at the leading edge of the normal/reverse switch command signal when the LEDB instruction is used.



PROGRAM EXAMPLE

The following is an example of the program used to execute switching of normal/reverse display of characters on the screen of a display unit connected to the AD57 loaded at X/Y0C0 to 0FF. Characters "A3ACPU" are displayed in the normal and reverse display modes at current cursor position on the screen of the display unit.



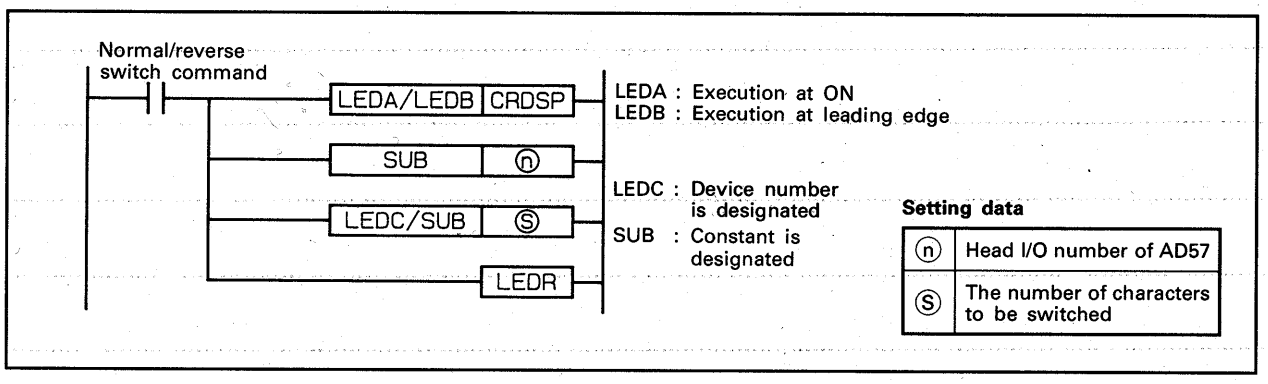

Display unit
A3ACPU A3ACPU
Display of characters after execution of the CNOR instruction
Display of characters after execution of the CREV instruction

MEMO

6.4.2 Normal/reverse display switching of characters being displayed·····CRDSP

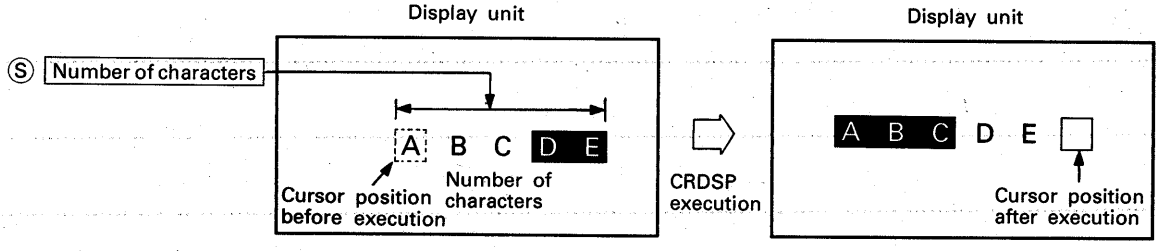
	Usable devices																				Digit specification	Number of steps	Subset	Index	Carry flag	Error flag
	Bit device							Word (16-bit) device									Constant		Pointer		Level					
	X	Y	M	L	S	B	F	T	C	D	W	R	A0	A1	Z	V	K	H	P	I	N				M9012	M9011
ⓝ																	○	○								
Ⓢ								○	○	○	○	○					○	○					20		○		○

*1: The number of steps varies with type of device used. See Section 5.2.



FUNCTION

(1) The CRDSP instruction is used to switch display mode (normal/reverse) of characters, which are being displayed on the screen of a display unit connected to the AD57(S1)/AD58 designated by ⓝ, of the number designated by Ⓢ starting with the cursor position.



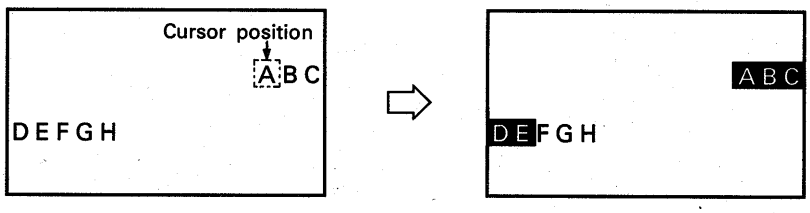
(2) Execution of the CRDSP instruction switches normal character display to reverse display or reverse display to normal display.

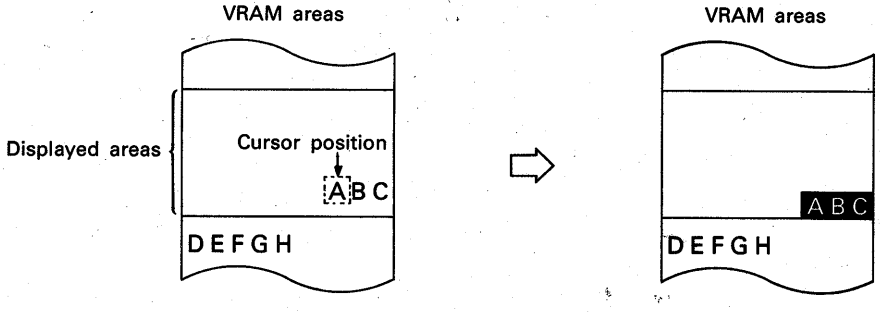
(3) The head I/O number of the AD57(S1)/AD58 designated by ⓝ should be upper 2 digits of 3 hexadecimal digits.
Example) If the AD57(S1)/AD58 is assigned to X.Y120 to 13F, set "12_H" at ⓝ.

(4) The number of characters designated by Ⓢ can be selected from 1 to the total number of characters starting with the cursor position to the last column on the last line on the screen.

(5) If the range of the number of characters designated by (S) exceeds the last column on a line, the excess range laps around to the next line.
If the designated range exceeds the last column of the last line on the screen, display switching is executed only for the characters being displayed.

When Ⓢ 5:



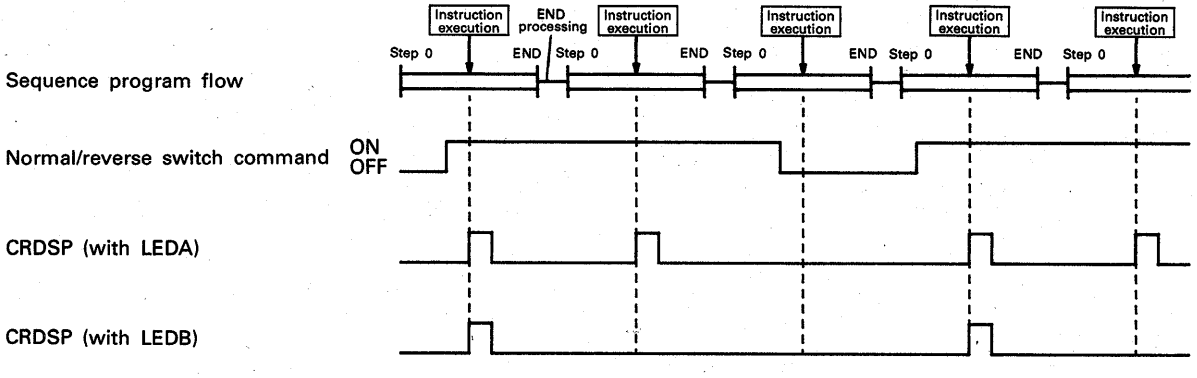


(6) After execution of the CRDSP instruction, conditions of the display become as follows.

Item	Condition
Display mode	(no change)
Cursor line position	Plus one line if the designated range exceeds the last column.
Cursor column position	Current cursor position plus designated number of characters
Head VRAM address displayed	(no change)
Normal/reverse designation	
Color designation	
Cursor display	

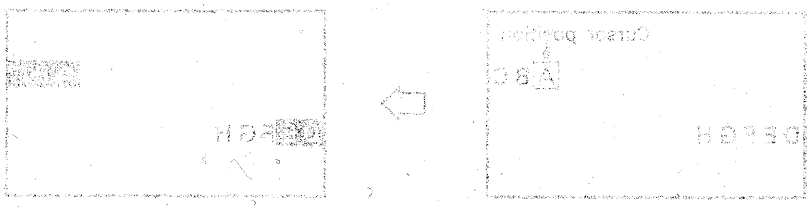
EXECUTION CONDITION

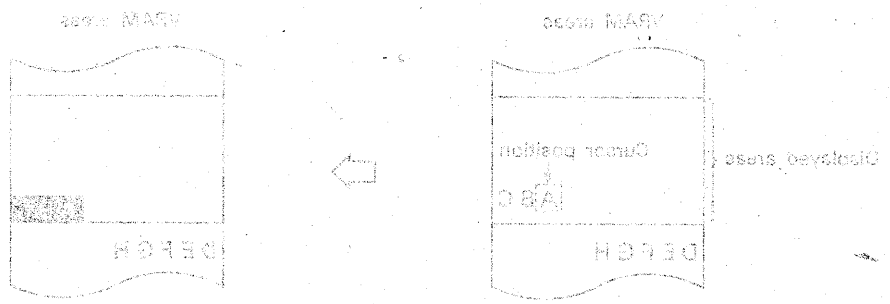
The CRDSP instruction is executed every scan while the normal/reverse switch command is ON when the LEDA instruction is used. It is executed only once at the leading edge of the normal/reverse switch command signal when the LEDB instruction is used.



OPERATION ERROR In the following case, an operation error occurs and an error flag (M9011) is set.

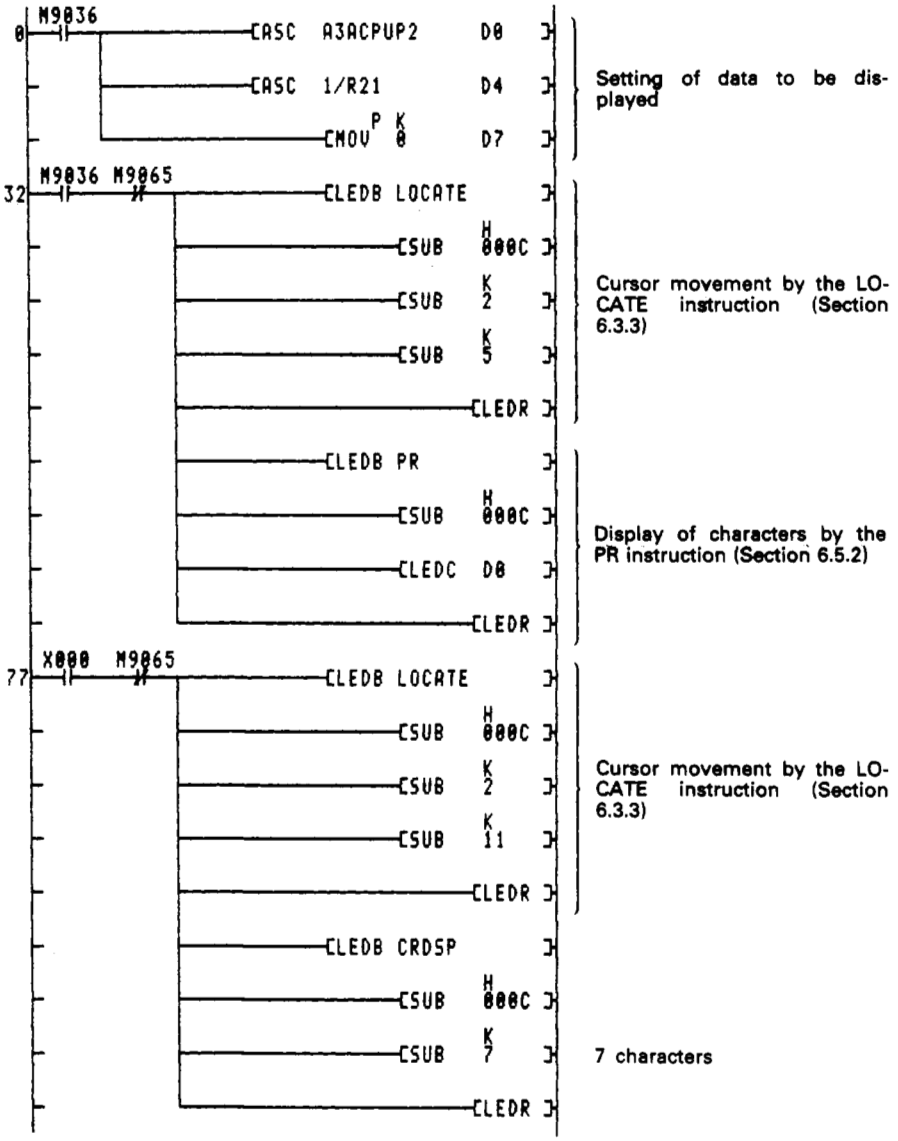
Description	Error Code	
	D9008	D9091
The number of characters designated by Ⓢ is 0 or a negative value.	50	503



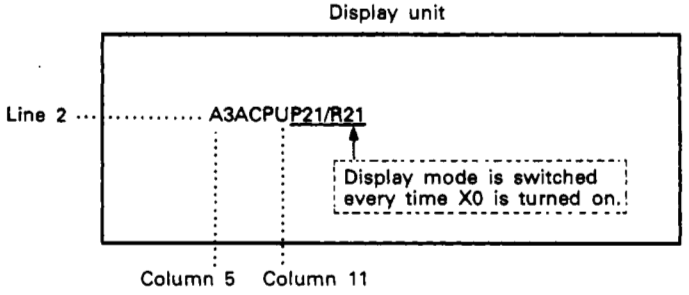


PROGRAM EXAMPLE

The following is an example of the program used to execute switching of normal/reverse display of characters on the screen of a display unit connected to the AD57 loaded at X/Y0C0 to 0FF. Characters "P21/R21" of "A3ACPUP21/R21" are switched between the normal and reverse display modes by turning on X000.



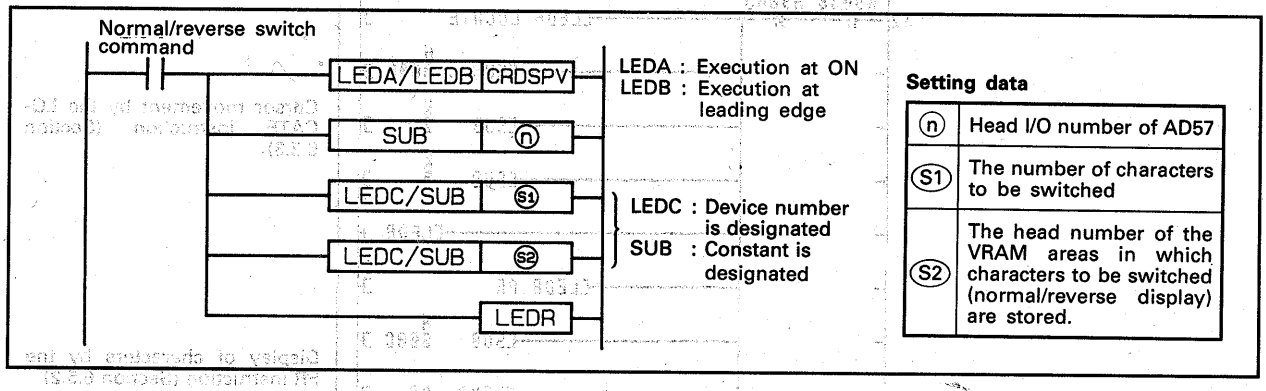
Since characters "A3ACPUP21/R21" are displayed starting at column 5 on line 2, the range of characters for display switching is designated starting at column 11 on line 2 for 7 characters.



6.4.3 Normal/reverse display switching of characters in the VRAM areas·····CRDSPV

	Usable devices																				Digit specification	Number of steps	Subset	Index	Carry flag	Error flag
	Bit device							Word (16-bit) device									Constant		Pointer		Level						
	X	Y	M	L	S	B	F	T	C	D	W	R	A0	A1	Z	V	K	H	P	I	N					M9012	M9011
ⓝ																	○	○									
(S1)								○	○	○	○	○					○	○					23		○		○
(S1)								○	○	○	○	○					○	○									

*1: The number of steps varies with type of device used. See Section 5.2.

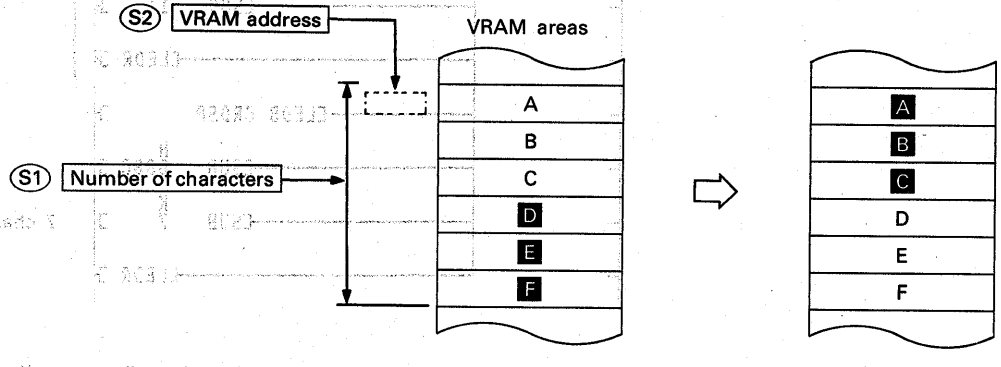


Setting data

ⓝ	Head I/O number of AD57
(S1)	The number of characters to be switched
(S2)	The head number of the VRAM areas in which characters to be switched (normal/reverse display) are stored.

FUNCTION

(1) The CRDSPV instruction is used to switch display mode (normal/reverse) of characters, which are stored in the VRAM areas and to be displayed on a display unit connected to the AD57(S1)/AD58 designated by ⓝ.
The range of characters for display switching starts at the address designated by (S2) in the VRAM areas and covers the number of characters designated by (S1).



(2) Execution of the CRDSPV instruction switches normal character display to reverse display or reverse display to normal display.

(3) The head I/O number of the AD57(S1)/AD58 designated by ⓝ should be upper 2 digits of 3 hexadecimal digits.
Example) If the AD57(S1)/AD58 is assigned to X.Y120 to 13F, set "12_H" at ⓝ.

(4) The VRAM addresses designated by (S2) can be set within the range of 0 to 7679.
(See Section 1.1.1 for detail of the VRAM addresses.)

(5) The number of characters designated by (S1) can be set at any number of characters stored at addresses starting with the address designated by (S2) to address 7679.

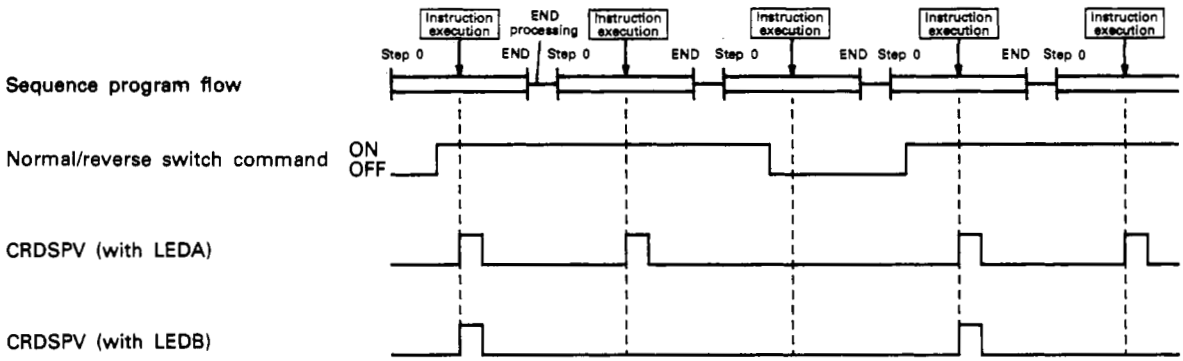
(6) If designated VRAM areas include the areas being displayed on the display unit, the display mode of the characters being displayed on the screen also switches.

(7) After execution of the CRDSPV instruction, conditions of the display become as follows.

Item	Condition
Display mode	(no change)
Cursor line position	
Cursor column position	
Head VRAM address displayed	
Normal/reverse designation	
Color designation	
Cursor display	

EXECUTION CONDITION

The CRDSPV instruction is executed every scan while the normal/reverse switch command is ON when the LEDA instruction is used. It is executed only once at the leading edge of the normal/reverse switch command signal when the LEDB instruction is used.



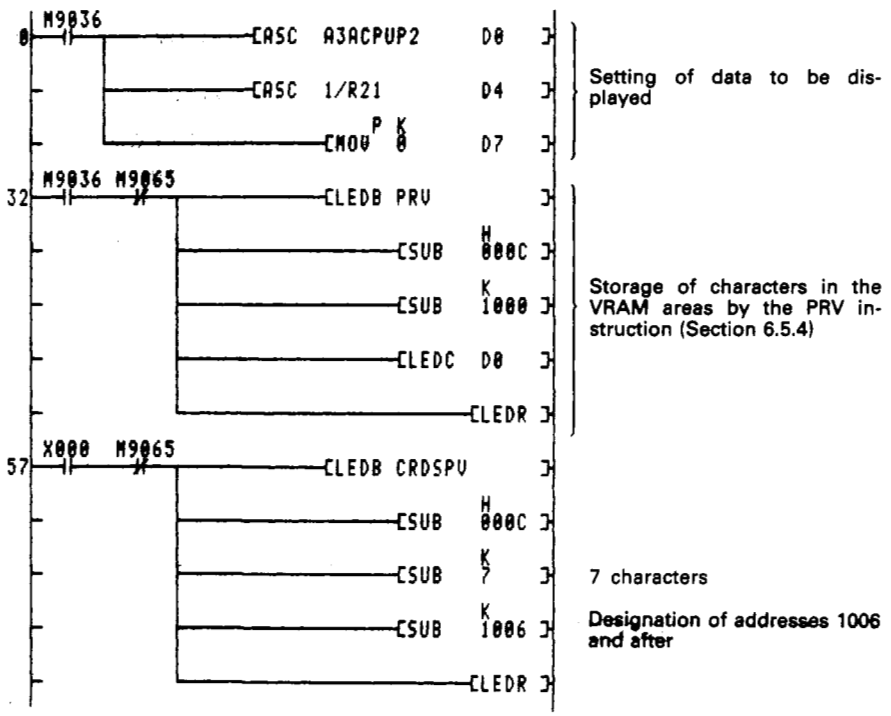
OPERATION ERROR

In the following cases, an operation error occurs and an error flag (M9011) is set.

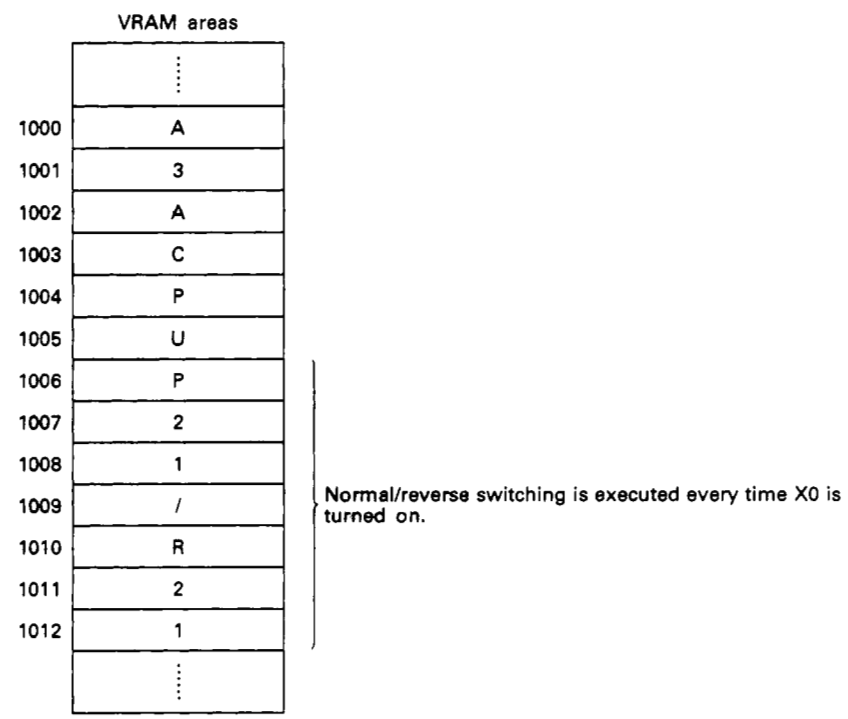
Description	Error Code D9008	Error Code D9091
The number of characters designated by (S1) is 0 or a negative value.	50	504
The VRAM area address designated by (S2) is out of the range from 0 to 7679.		
The range of the number of characters designated by (S1) starting with the address designated by (S2) exceeds address 7679 of the VRAM areas.		

PROGRAM EXAMPLE

The following is an example of the program used to execute switching of normal/reverse display of characters stored in the VRAM areas of the AD57 loaded at X/Y0C0 to 0FF.
Characters stored at addresses 1007 to 1013 are switched between the normal and reverse display modes by turning on X000.



In this example, characters "A3ACPUP21/R21" are written to the VRAM areas at addresses 1000 and after, and the display mode of "P21/R21" is switched.
By setting the head of the VRAM addresses to be displayed at address 1000 or before by use of the CPS2 instruction, condition of display mode switching can be monitored on the display unit.

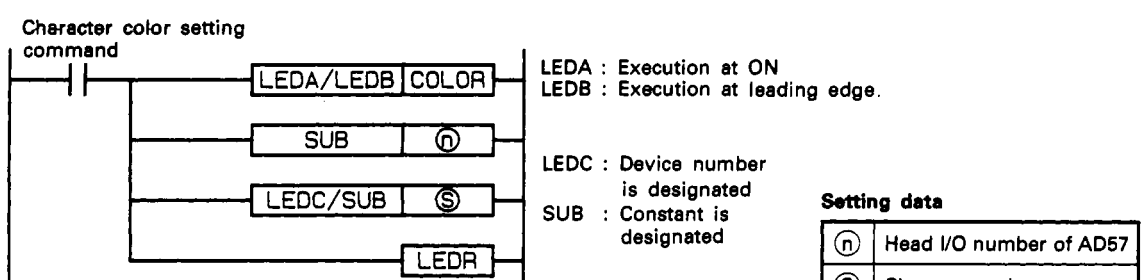


MEMO

6.4.4 Character color designation·····COLOR

	Usable devices																			Digit specification	Number of steps	Subset	Index	Carry flag	Error flag
	Bit device							Word (16-bit) device								Constant		Pointer		Level					
	X	Y	M	L	S	B	F	T	C	D	W	R	A0	A1	Z	V	K	H	P	I	N					M9012	M9011
ⓝ																	○	○									
Ⓢ								○	○	○	○	○					○	○					20		○		○

*1: The number of steps varies with type of device used. See Section 5.2.



FUNCTION

(1) The COLOR instruction is used to designate color of characters, which are to be displayed on a display unit connected to the AD57(S1)/AD58 designated by ⓝ, to the color which corresponds to the color code designated by Ⓢ.

(2) The head I/O number of the AD57(S1)/AD58 designated by ⓝ should be upper 2 digits of 3 hexadecimal digits.
Example) If the AD57(S1)/AD58 is assigned to X.Y120 to 13F, set "12_H" at ⓝ.

(3) Tables shown below indicate available character colors and corresponding color codes to be designated by Ⓢ.

Color	Color Code
Black	0
Blue	1
Red	2
Purple	3

Color	Color Code
Green	4
Light blue	5
Yellow	6
White	7

(4) If color of a character is already set by use of the canvas screen data, color designation by the COLOR instruction is ignored.

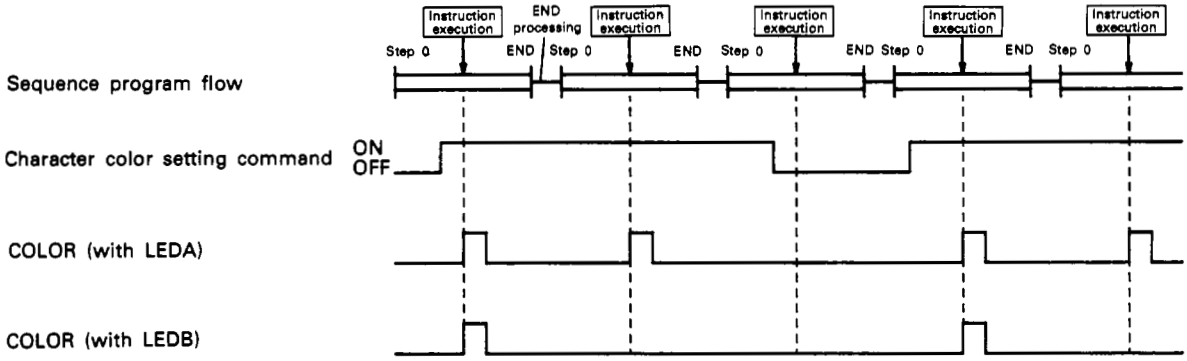
(5) Character color designation automatically switches to white when the following instructions are executed.
CPS1
CPS2
CLS

(6) After execution of the CMODE instruction, conditions of the display become as follows.

Item	Condition
Display mode	(no change)
Cursor line position	
Cursor column position	
Head VRAM address displayed	
Normal/reverse designation	
Color designation	Designated color code
Cursor display	(no change)

EXECUTION CONDITION

The COLOR instruction is executed every scan while the character color setting command is ON when the LEDA instruction is used. It is executed only once at the leading edge of the character color setting command signal when the LEDB instruction is used.



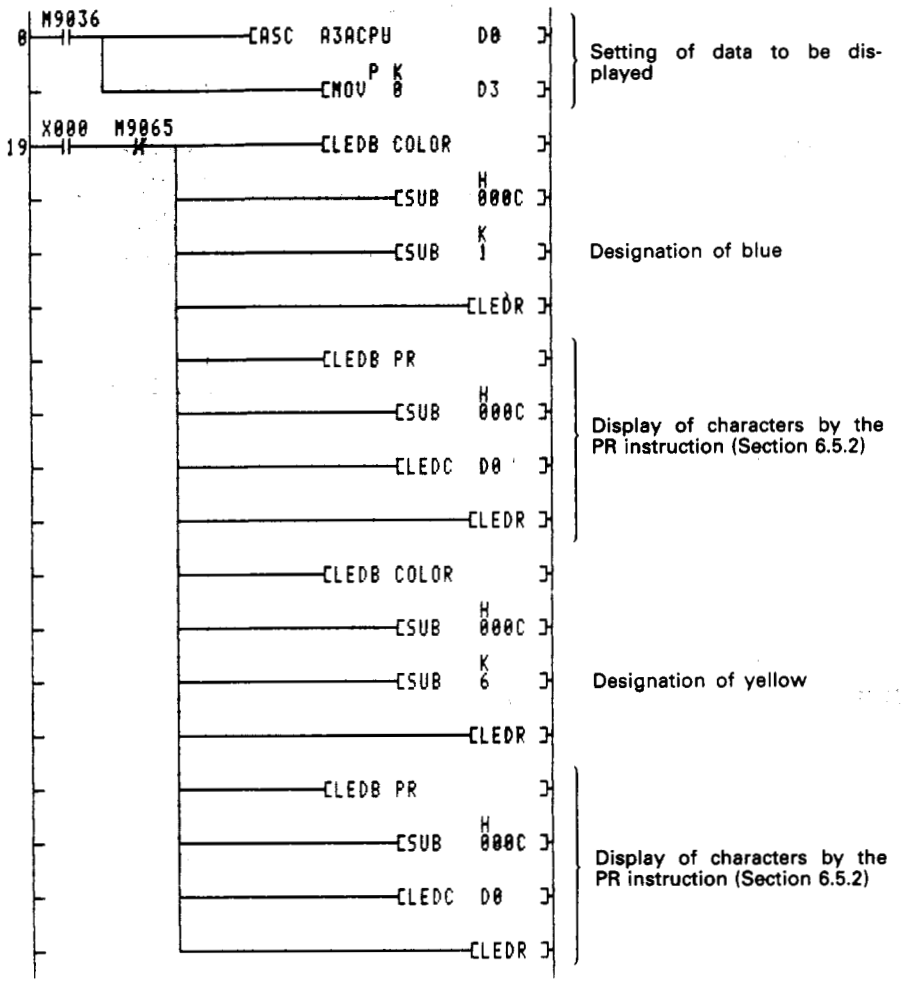
OPERATION ERROR

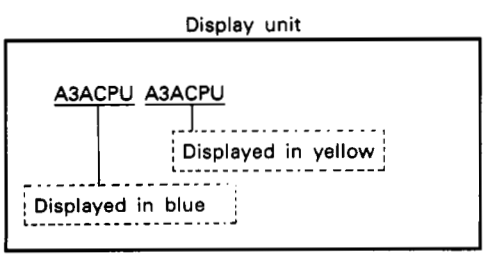
In the following case, an operation error occurs and an error flag (M9011) is set.

Description	Error Code	
	D9008	D9091
The color code designated by (S) is out of the range from 0 to 7.	50	503

PROGRAM EXAMPLE

The following is an example of the program used to designate color of the characters to be displayed on the display unit connected to the AD57 loaded at X/Y0C0 to 0FF.
Characters "A3ACPU" are displayed in blue and then in yellow at current cursor position on the screen by turning on X0.



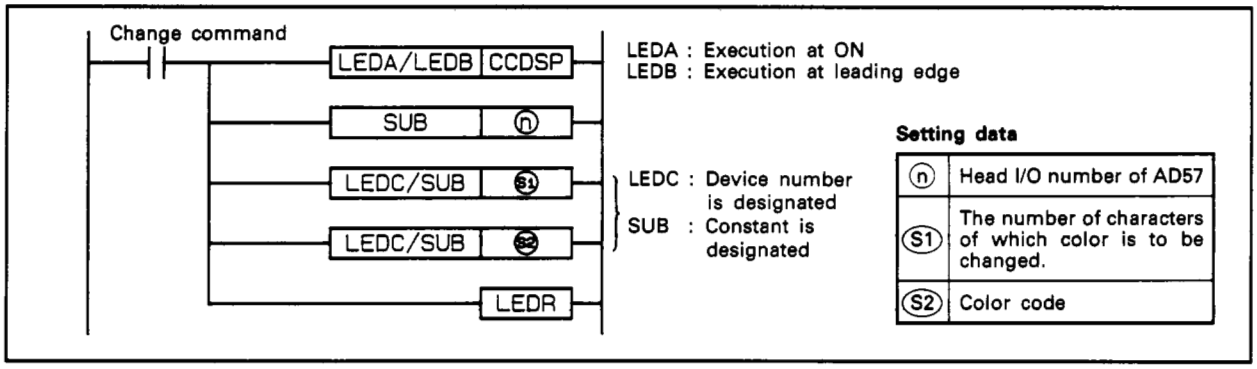


MEMO

6.4.5 Change of character color being displayed·····CCDSP

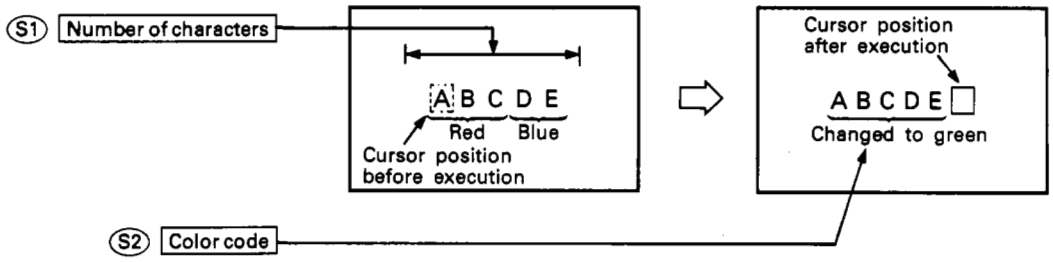
	Usable devices																			Digit specification	Number of steps	Subset	Index	Carry flag	Error flag
	Bit device							Word (16-bit) device								Constant		Pointer		Level					
	X	Y	M	L	S	B	F	T	C	D	W	R	A0	A1	Z	V	K	H	P	I	N					M9012	M9011
ⓝ																	○	○									
(S1)								○	○	○	○	○					○	○					23		○		○
(S2)								○	○	○	○	○					○	○									

*1: The number of steps varies with type of device used. See Section 5.2.


Change command
LEDA/LEDB CCDSP
SUB ⓝ
LEDC/SUB (S1)
LEDC/SUB (S2)
LEDR
LEDA : Execution at ON
LEDB : Execution at leading edge
LEDC : Device number is designated
SUB : Constant is designated
Setting data
ⓝ Head I/O number of AD57
(S1) The number of characters of which color is to be changed.
(S2) Color code

FUNCTION

(1) The CCDSP instruction is used to change color of the number of characters designated by (S1), which are being displayed on a display unit connected to the AD57(S1)/AD58 designated by ⓝ, to the color which corresponds to the color code designated by (S2) starting with the character at the cursor position.



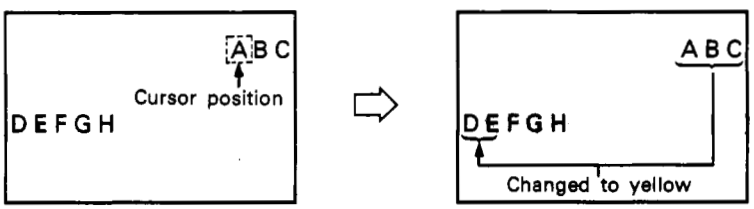
(2) The CCDSP instruction changes only the display color of designated characters.
The color of characters after execution of the CCDSP instruction is the color designated by the COLOR instruction.

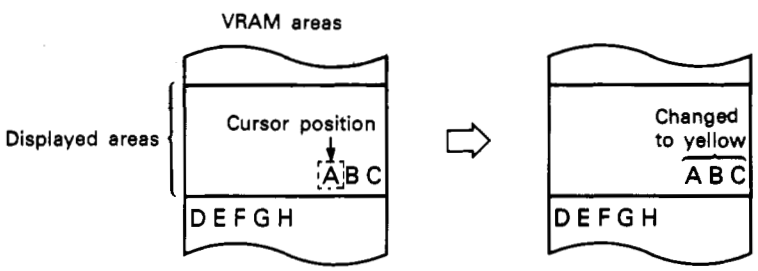
(3) The head I/O number of the AD57(S1)/AD58 designated by ⓝ should be upper 2 digits of 3 hexadecimal digits.
Example) If the AD57(S1)/AD58 is assigned to X.Y120 to 13F, set "12_H" at ⓝ.

(4) The number of characters designated by (S1) can be selected from 1 to the total number of characters starting with the cursor position to the last column on the last line on the screen.

(5) If the range of the number of characters designated by (S1) starting at the cursor position exceeds the last column on a line, the excess range laps around to the next line.
If the designated range exceeds the last column of the last line on the screen, color changing is executed only for the characters being displayed.

When (S1) 5 and (S2) = 6:





(6) Tables shown below indicate available character colors and corresponding color codes to be designated by (S2).

Color	Color Code
Black	0
Blue	1
Red	2
Purple	3

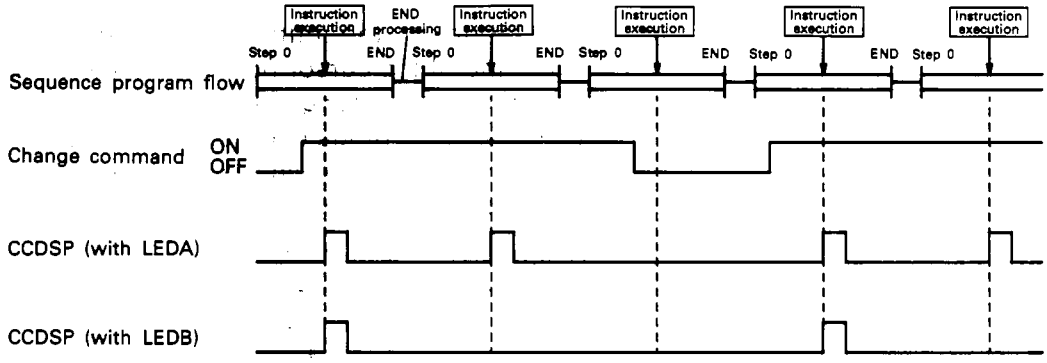
Color	Color Code
Green	4
Light blue	5
Yellow	6
White	7

(7) After execution of the CCDSP instruction, conditions of the display become as follows.

Item	Condition
Display mode	(no change)
Cursor line position	Plus one line if the designated range exceeds the last column.
Cursor column position	Current cursor position plus designated number of characters
Head VRAM address displayed	(no change)
Normal/reverse designation	
Color designation	
Cursor display	

EXECUTION CONDITION

The CCDSP instruction is executed every scan while the change command is ON when the LEDA instruction is used. It is executed only once at the leading edge of the change command signal when the LEDB instruction is used.



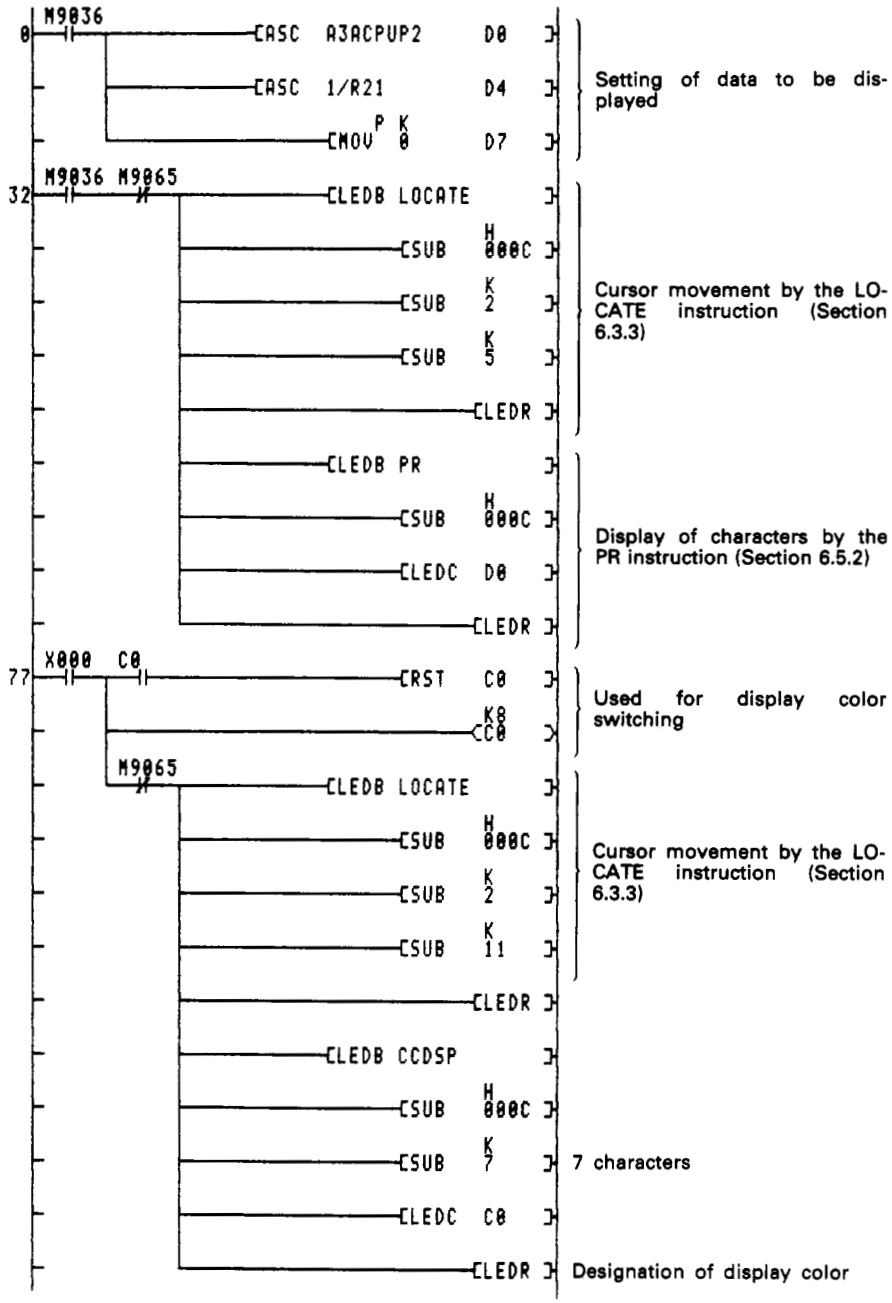
OPERATION ERROR

In the following cases, an operation error occurs and an error flag (M9011) is set.

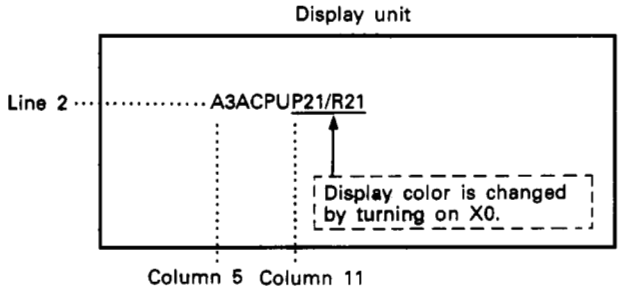
Description	Error Code	
	D9008	D9091
The number of characters designated by (S2) is 0 or a negative value.	50	503
The color code designated by (S2) is out of the range from 0 to 7.		

PROGRAM EXAMPLE

The following is an example of the program used to change color of the characters being displayed on a display unit connected to the AD57 loaded at X/Y0C0 to 0FF.
Color of characters "P21/R21" of "A3ACPUP21/R21" being displayed is changed from black to blue, red, purple, green, light blue, yellow, white and black by turning on X000.



Since characters "A3ACPUP21/R21" are displayed starting at column 5 on line 2, the range of characters for display switching is designated starting at column 11 on line 2 for 7 characters.
In this example, the number of inputs of X000 is counted by C0, and the result of counting is used as the color code.

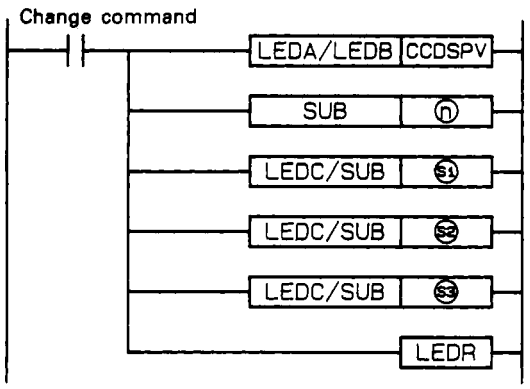


MEMO

6.4.6 Change of character color in the VRAM areas·····CCDSPV

	Usable devices																				Digit specification	Number of steps	Subset	Index	Carry flag	Error flag
	Bit device							Word (16-bit) device									Constant		Pointer		Level					
	X	Y	M	L	S	B	F	T	C	D	W	R	A0	A1	Z	V	K	H	P	I	N					
ⓝ																	○	○							M9012	M9011
(S1)								○	○	○	○	○					○	○								
(S2)								○	○	○	○	○					○	○								
(S3)								○	○	○	○	○					○	○								
																						26		○		○

*1: The number of steps varies with type of device used. See Section 5.2.

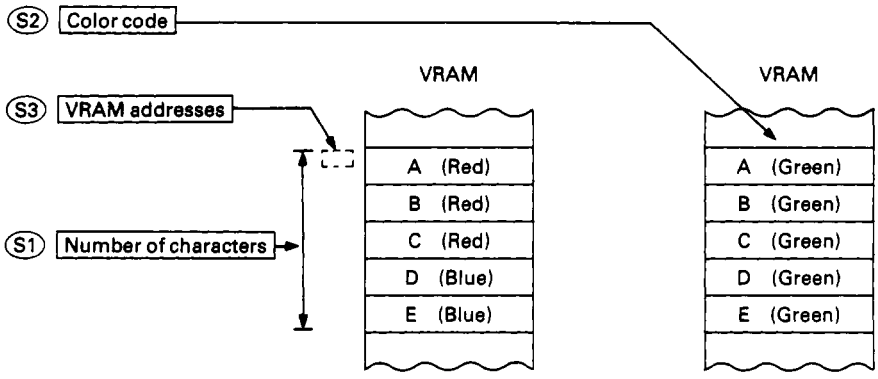


Setting data

ⓝ	Head I/O number of AD57
(S1)	The number of characters of which color is to be changed.
(S2)	Color code
(S3)	The head number of the VRAM areas in which characters to be changed in color are stored.

FUNCTION

(1) The CCDSPV instruction is used to change color of the number of characters designated by (S1), which are stored in the VRAM areas of the AD57(S1)/AD58 designated by ⓝ, to the color which corresponds to the color code designated by (S2) starting with the address designated by (S3).



(2) The CCDSPV instruction changes only the display color of designated characters.
The color of characters after execution of the CCDSPV instruction is the color designated by the COLOR instruction.

(3) The head I/O number of the AD57(S1)/AD58 designated by ⓝ should be upper 2 digits of 3 hexadecimal digits.
Example) If the AD57(S1)/AD58 is assigned to X.Y120 to 13F, set "12H" at ⓝ.

(4) The VRAM addresses designated by (S3) can be set within the range of 0 to 7679.
(See Section 1.1.1 for detail of the VRAM addresses.)

(5) The number of characters designated by (S1) can be set at any number of characters stored at addresses starting with the address designated by (S3) to address 7679.

(6) If designated VRAM areas include the areas being displayed on the display unit, the display mode of the characters being displayed on the screen also switches.

(7) Tables shown below indicate available character colors and corresponding color codes to be designated by (S2).

Color	Color Code
Black	0
Blue	1
Red	2
Purple	3

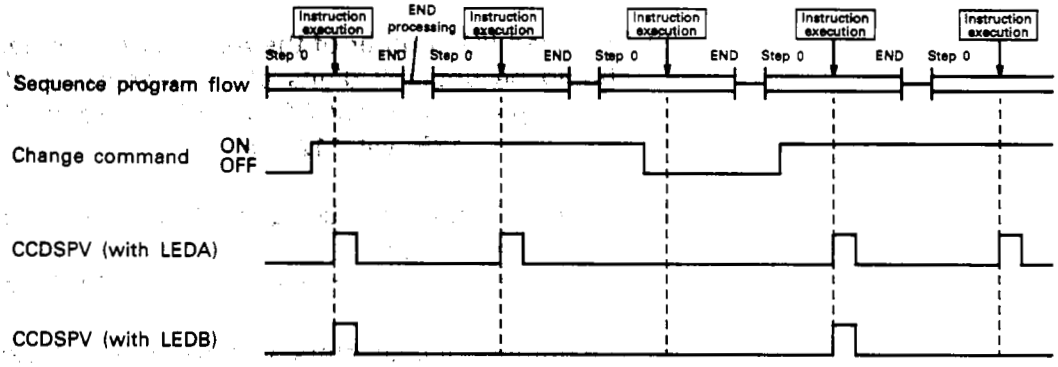
Color	Color Code
Green	4
Light blue	5
Yellow	6
White	7

(8) After execution of the CCDSPV instruction, conditions of the display become as follows.

Item	Condition
Display mode	(no change)
Cursor line position	
Cursor column position	
Head VRAM address displayed	
Normal/reverse designation	
Color designation	
Cursor display	

EXECUTION CONDITION

The CCDSPV instruction is executed every scan while the change command is ON when the LEDA instruction is used. It is executed only once at the leading edge of the change command signal when the LEDB instruction is used.



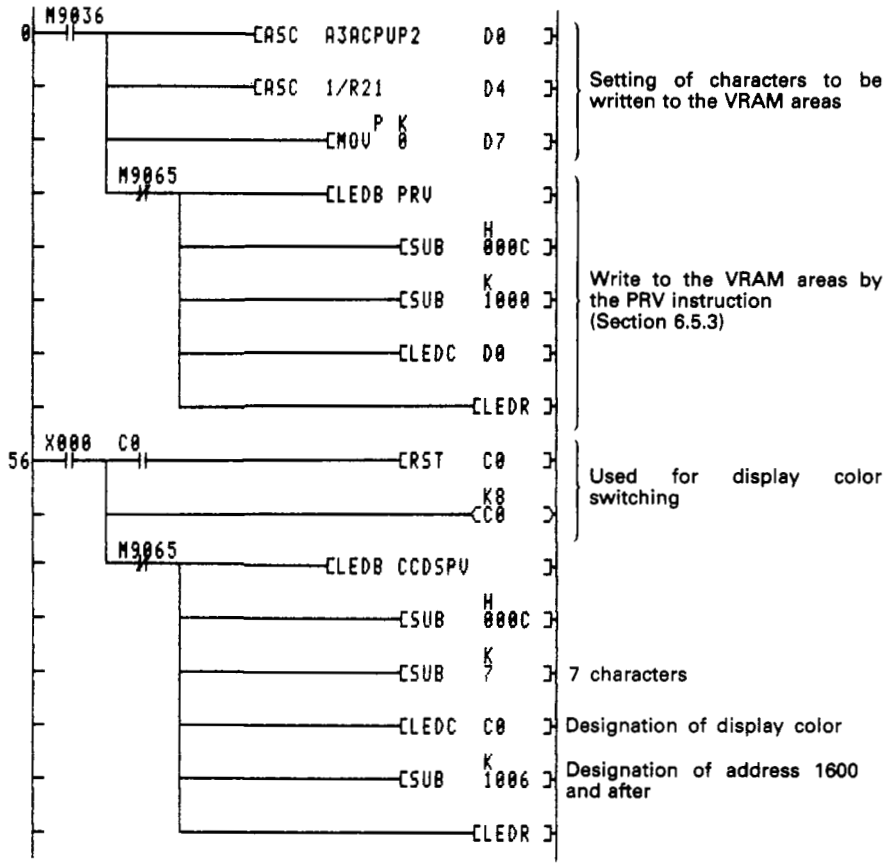
OPERATION ERROR

In the following cases, an operation error occurs and an error flag (M9011) is set.

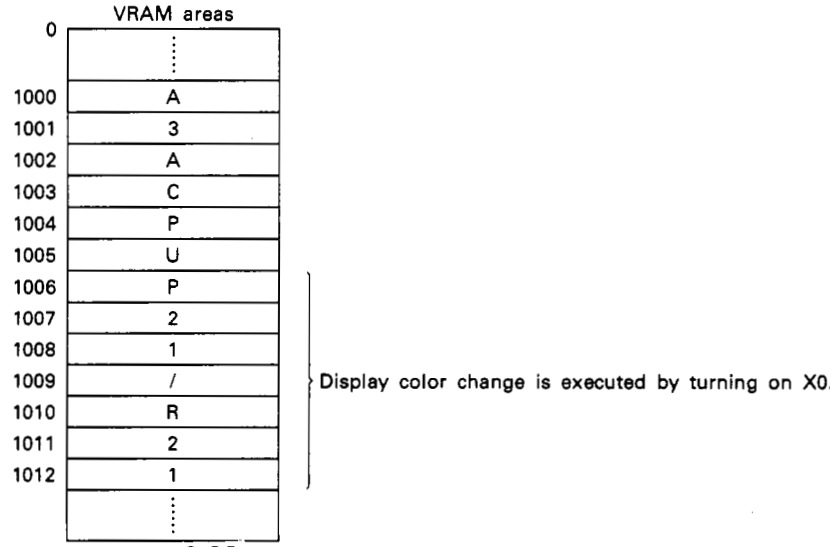
Description	Error Code	
	D9008	D9091
The color code designated by (S2) is out of the range from 0 to 7.	50	503
The number of characters designated by (S1) is 0 or a negative value.		504
The VRAM area address designated by (S2) is out of the range from 0 to 7679.		
The range of the number of characters designated by (S1) starting with the address designated by (S3) exceeds address 7679 of the VRAM areas.		

PROGRAM EXAMPLE

The following is an example of the program used to change color of the characters stored in the VRAM areas of the AD57 loaded at X/Y0C0 to 0FF.
Color of the characters stored at addresses 1007 to 1013 in the VRAM areas is changed from black to blue, red, purple, green, light blue, yellow, white and black by turning on X000.



In this program, characters "A3ACPUP21/R21" are written to address 1000 and after in the VRAM areas, and display color of "P21/R21" is changed.
By setting the head of the VRAM addresses to be displayed at address 1000 or before by use of the CPS2 instruction, color changing can be monitored on the display unit.



MEMO

6.5 Designated Character Display Instructions

The designated character display instructions are used to display designated characters on a display unit or to write designated characters to the VRAM areas.

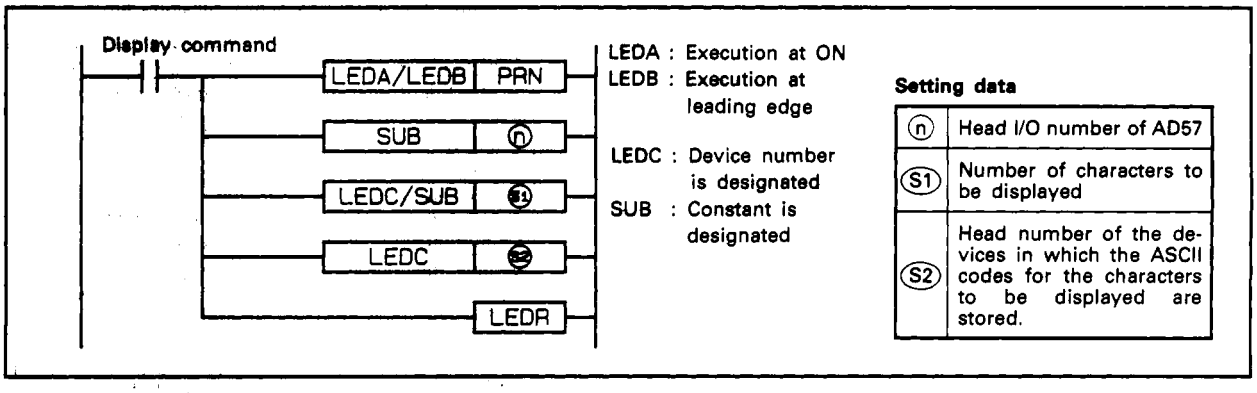
Designated character display and write are executed using the instructions mentioned below.

Category	Instruction Name	Description
ASCII character display	PRN	Displays designated number of ASCII characters.
	PR	Displays the ASCII characters till code 00_H.
ASCII character write to the VRAM	PRNV	Writes designated number of ASCII characters to the VRAM areas beginning with designated address.
	PRV	Writes the ASCII characters till code 00_H to the VRAM areas beginning with designated address.
Designated character display	EPRN	Displays designated number of characters which correspond to character codes 0 to $3FF_H$.
	EPR	Writes characters till code 00_H (characters which correspond to 1 to $3FF_H$) to the VRAM areas beginning with designated address.
Designated character write to the VRAM	EPRNV	Writes designated number of characters which correspond to character codes 0 to $3FF_H$ to the VRAM areas beginning with designated address.
	EPRV	Writes designated number of characters till code 00_H (characters which correspond to 1 to $3FF_H$) to the VRAM areas beginning with designated address.
Horizontal repeated display of characters	CR1	Displays a designated character horizontally for designated number of times of repetition.
	CR2	Displays a pair of designated characters horizontally for designated number of times of repetition.
Vertical repeated display of characters	CC1	Displays a designated character vertically for designated number of times of repetition.
	CC2	Displays a pair of designated characters vertically for designated number of times of repetition.

6.5.1 Display of designated number of the ASCII characters·····PRN

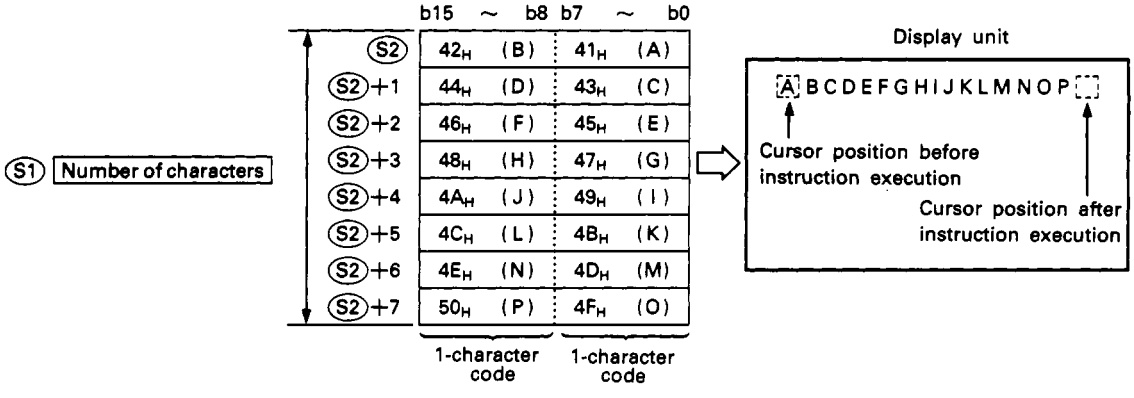
	Usable devices																			Dist specification	Number of steps	Subset	Index	Carry flag	Error flag
	Bit device							Word (16-bit) device								Constant		Pointer		Level					
	X	Y	M	L	S	B	F	T	C	D	W	R	A0	A1	Z	V	K	H	P	I	N					M9012	M9011
ⓝ																	○	○									
(S1)								○	○	○	○	○					○	○					23		○		○
(S2)								○	○	○	○	○					○	○									

*1: The number of steps varies with type of device used. See Section 5.2.



FUNCTION

(1) The PRN instruction is used to display designated ASCII characters beginning with current cursor position on the display unit of the AD57(S1)/AD58 designated by ⓝ.
The ASCII characters to be displayed correspond to the ASCII codes which are stored in the devices which correspond to the number of characters designated by (S1) beginning with the device number designated by (S2).

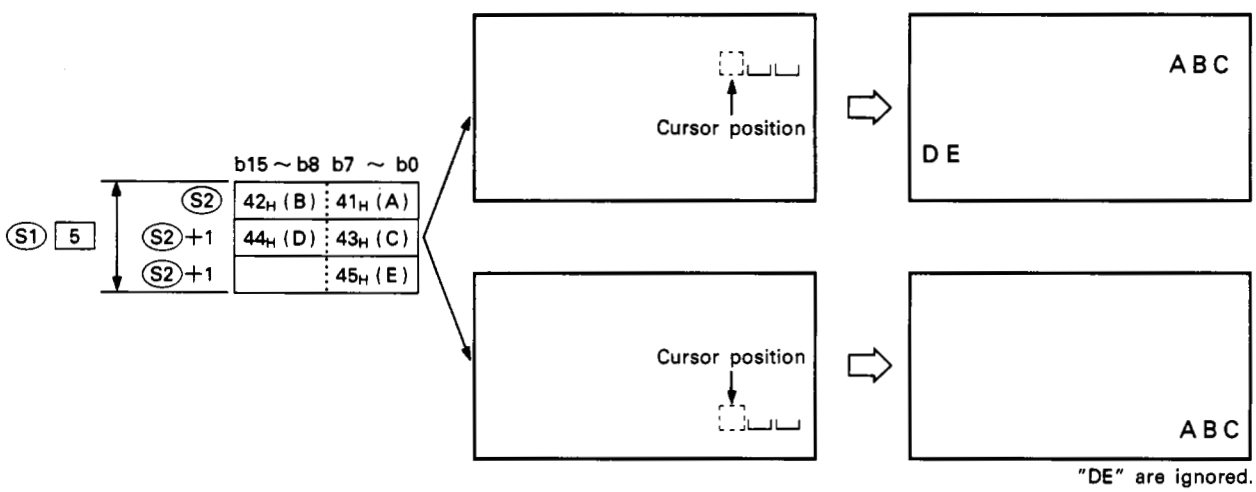

(S1) Number of characters
b15 ~ b8 b7 ~ b0
(S2) 42H (B) 41H (A)
(S2)+1 44H (D) 43H (C)
(S2)+2 46H (F) 45H (E)
(S2)+3 48H (H) 47H (G)
(S2)+4 4AH (J) 49H (I)
(S2)+5 4CH (L) 4BH (K)
(S2)+6 4EH (N) 4DH (M)
(S2)+7 50H (P) 4FH (O)
1-character code
1-character code
Display unit
A B C D E F G H I J K L M N O P
Cursor position before instruction execution
Cursor position after instruction execution

(2) The head I/O number of the AD57(S1)/AD58 designated by ⓝ should be upper 2 digits of 3 hexadecimal digits.
Example) If the AD57(S1)/AD58 is assigned to X.Y120 to 13F, set "12_H" at ⓝ.

(3) The number of characters designated by (S1) can be selected from 1 to the total number of characters beginning with the cursor position to the last column on the last line on the screen.
However, the number of characters to be designated should not exceed the value specified by the last device which is designated by (S2).

(4) The ASCII codes to be stored in the devices designated by (S2) can be set in the range of 00_H to FF_H.

(5) If the range of the number of characters designated by (S1) beginning with the cursor position exceeds the last column on a line, the excess range laps around to column 0 on the next line.
If the designated range exceeds the last column of the last line on the screen, characters up to the last column on the last line are displayed. The excess characters are ignored.



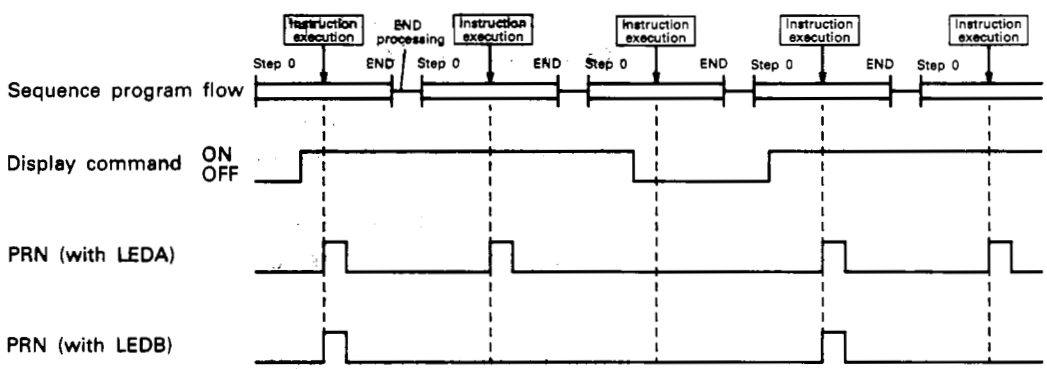
"DE" are ignored.

(6) After execution of the PRN instruction, conditions of the display become as follows.

Item	Condition
Display mode	(no change)
Cursor line position	Plus one line if the designated range exceeds the last column.
Cursor column position	Current cursor position plus designated number of characters
Head VRAM address displayed	(no change)
Normal/reverse designation	
Color designation	
Cursor display	

EXECUTION CONDITION

The PRN instruction is executed every scan while the display command is ON when the LEDA instruction is used. It is executed only once at the leading edge of the display command signal when the LEDB instruction is used.



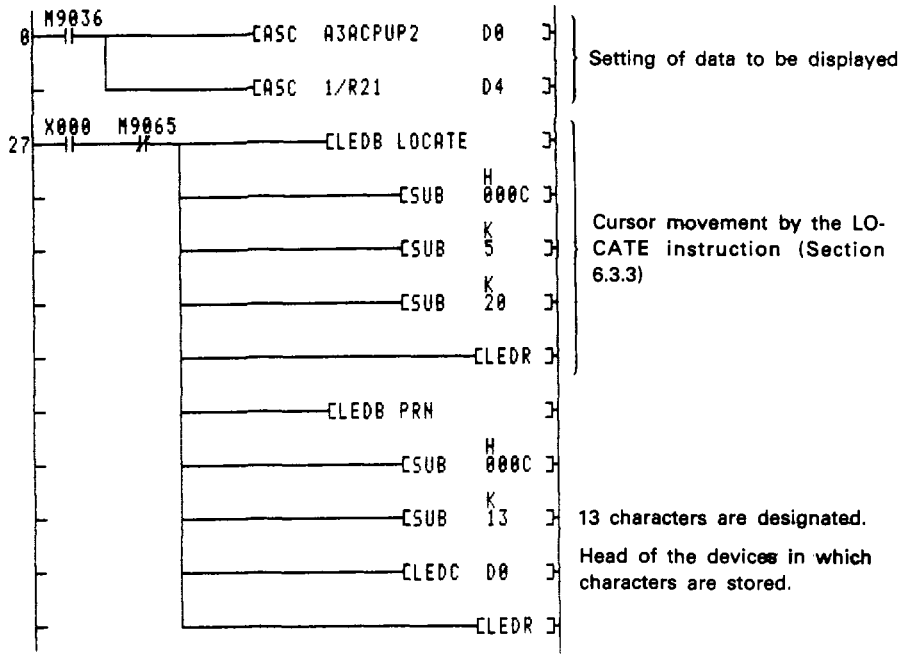
OPERATION ERROR

In the following cases, an operation error occurs and an error flag (M9011) is set.

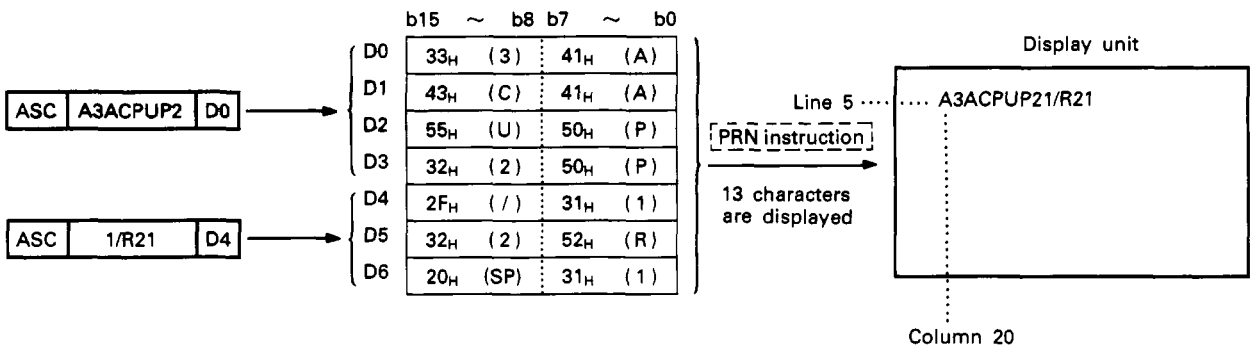
Description	Error Code	
	D9008	D9091
The range of the number of characters designated by (S1) beginning with the device number designated by (S2) exceeds the last device number of corresponding device.	50	504
The number of characters designated by (S1) is 0 or a negative value.		

PROGRAM EXAMPLE

The following is an example of the program used to display characters "A3ACPUP21/R21" at column 20 and after on line 5 on a display unit connected to the AD57 loaded at X/Y0C0 to 0FF. Characters "A3ACPUP21/R21" are displayed by turning on X000.



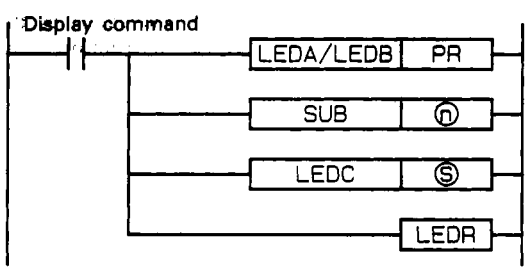
The ASCII instruction is used to convert characters to be displayed (A3ACPUP21/R21) to the ASCII codes. Converted ASCII codes are stored in D0 to D6.



6.5.2 Display of the ASCII characters up to code 00_H·····PR

	Usable devices																				Digit specification	Number of steps	Subset	Index	Carry flag	Error flag
	Bit device							Word (16-bit) device									Constant		Pointer		Level					
	X	Y	M	L	S	B	F	T	C	D	W	R	A0	A1	Z	V	K	H	P	I	N					M9012	M9011
ⓝ																	○	○					20		○		○
Ⓢ								○	○	○	○	○														

*1: The number of steps varies with type of device used. See Section 5.2.



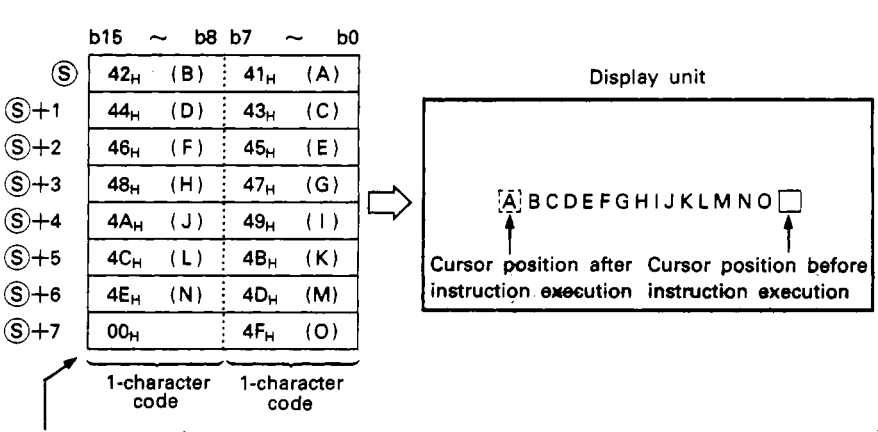
LEDA : Execution at ON
LEDB : Execution at leading edge

Setting data

ⓝ	Head I/O number of AD57
Ⓢ	Head number of the devices in which the ASCII codes for the characters to be displayed are stored.

FUNCTION

(1) The PR instruction is used to display designated ASCII characters beginning with current cursor position on the display unit of the AD57(S1)/AD58 designated by ⓝ.
The ASCII characters to be displayed correspond to the ASCII codes which are stored in the devices beginning with the device number designated by Ⓢ up to the device in which code "00_H" is stored.

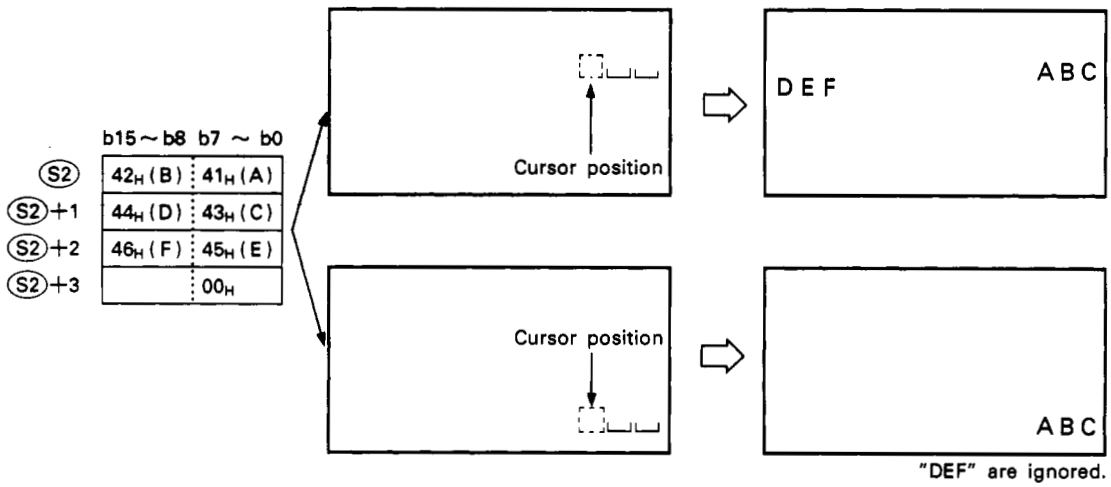

b15 ~ b8 b7 ~ b0
Ⓢ 42H (B) 41H (A)
Ⓢ+1 44H (D) 43H (C)
Ⓢ+2 46H (F) 45H (E)
Ⓢ+3 48H (H) 47H (G)
Ⓢ+4 4AH (J) 49H (I)
Ⓢ+5 4CH (L) 4BH (K)
Ⓢ+6 4EH (N) 4DH (M)
Ⓢ+7 00H 4FH (O)
1-character code
1-character code
End of range code
Display unit
A B C D E F G H I J K L M N O
Cursor position after instruction execution
Cursor position before instruction execution

(2) The head I/O number of the AD57(S1)/AD58 designated by ⓝ should be upper 2 digits of 3 hexadecimal digits.
Example) If the AD57(S1)/AD58 is assigned to X.Y120 to 13F, set "12_H" at ⓝ.

(3) The ASCII codes to be stored in the devices designated by Ⓢ can be set in the range of 01_H to FF_H.
Since code "00_H" designates the end of the range of characters to be displayed, it cannot be set as an ASCII code.

(4) The number of characters which can be displayed by one time of processing equals to the number of characters from the cursor position to the last column on the last line on the screen.

(5) If the range of the number of characters beginning with the cursor position exceeds the last column on a line, the excess range laps around to column 0 on the next line.
If the designated range exceeds the last column of the last line on the screen, characters up to the last column on the last line are displayed. The excess characters are ignored.



(6) After execution of the PR instruction, conditions of the display become as follows.

Item	Condition
Display mode	(no change)
Cursor line position	Plus one line if the designated range exceeds the last column.
Cursor column position Current cursor position plus designated number of characters	Current cursor position plus designated number of characters
Head VRAM address displayed	(no change)
Normal/reverse designation	
Color designation	
Cursor display	

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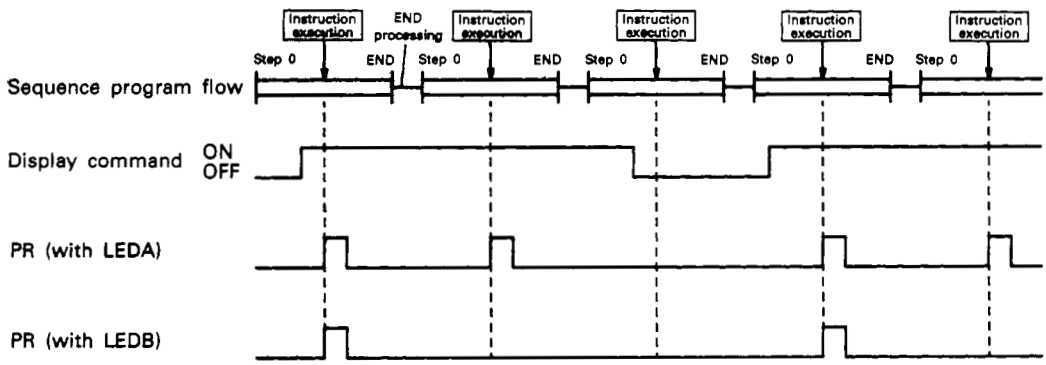
EXECUTION CONDITION

The PR instruction is executed every scan while the display command is ON when the LEDA instruction is used. It is executed only once at the leading edge of the display command signal when the LEDB instruction is used.



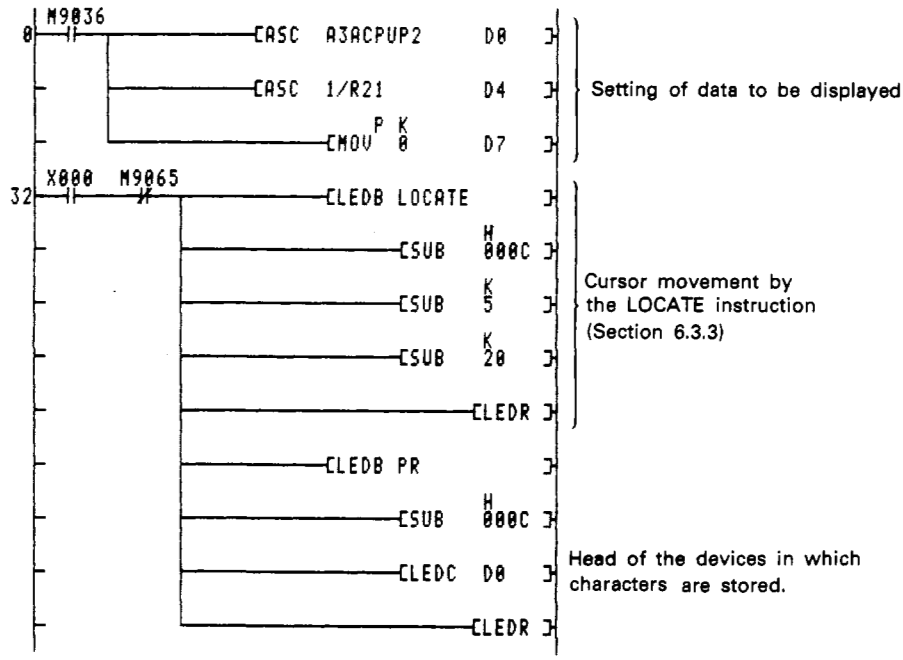
OPERATION ERROR

In the following cases, an operation error occurs and an error flag (M9011) is set.

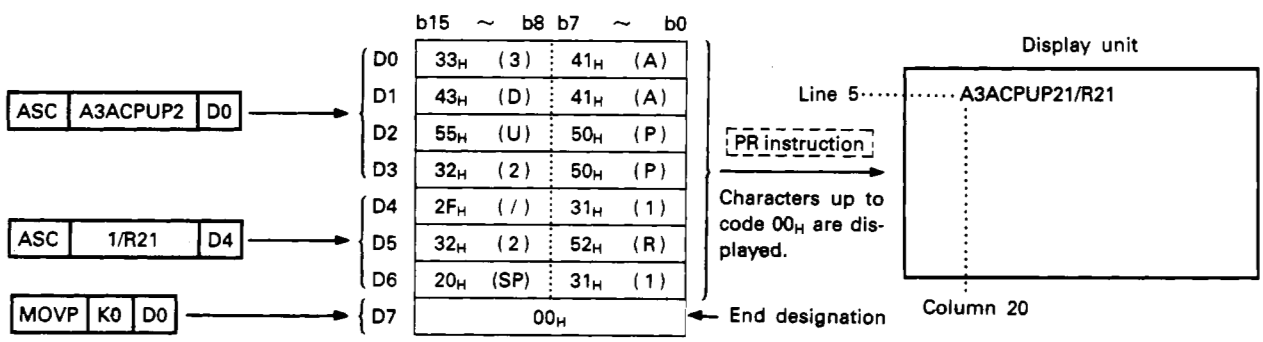
Description	Error Code	
	D9008	D9091
Code 00_H is not provided between the device number designated by (S) and the last device number of corresponding device.	50	504
The number of characters to be displayed is 0.		

PROGRAM EXAMPLE

The following is an example of the program used to display characters "A3ACPUP21/R21" at column 20 and after on line 5 on a display unit connected to the AD57 loaded at X/Y0C0 to 0FF. Characters "A3ACPUP21/R21" are displayed by turning on X000.



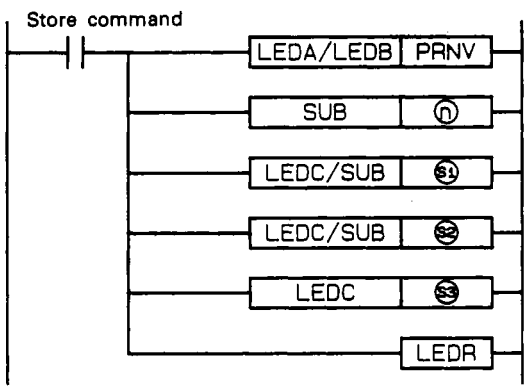
The ASCII instruction is used to convert characters to be displayed (A3ACPUP21/R21) to the ASCII codes. Converted ASCII codes are stored in D0 to D6.
"0" is stored in D7 to designate the end of the range of characters to be displayed.



6.5.3 Store of the ASCII characters of designated number of characters in the VRAM areas····· PRNV

	Usable devices																			Digit specification	Number of steps	Subset	Index	Carry flag	Error flag
	Bit device							Word (16-bit) device									Constant		Pointer		Level					
	X	Y	M	L	S	B	F	T	C	D	W	R	A0	A1	Z	V	K	H	P	I	N					M9012	M9011
ⓝ																	○	○									
(S1)								○	○	○	○	○					○	○					26		○		○
(S2)								○	○	○	○	○					○	○									
(S3)								○	○	○	○	○															

*1: The number of steps varies with type of device used. See Section 5.2.

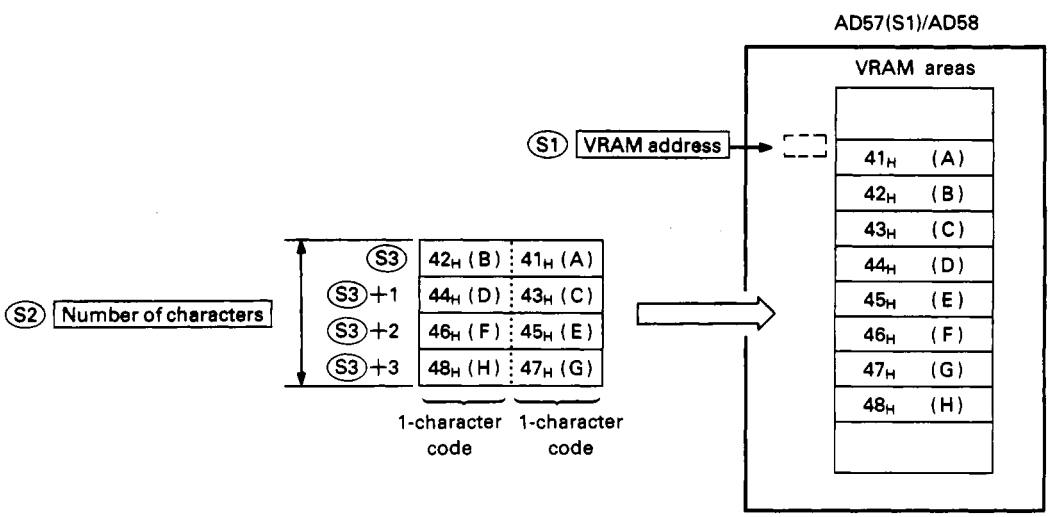


Setting data

ⓝ	Head I/O number of AD57
(S1)	Head address of the VRAM areas where the ASCII characters are to be stored
(S2)	Number of characters to be stored
(S3)	Head number of the devices in which the ASCII codes for the characters to be stored are stored.

FUNCTION

(1) The PRNV instruction is used to store designated ASCII characters in the VRAM areas of the AD57(S1)/AD58 designated by ⓝ beginning with the address designated by (S1). The ASCII characters to be stored correspond to the ASCII codes which are stored in the devices which correspond to the number of characters designated by (S2) beginning with the device number designated by (S3).



(2) The head I/O number of the AD57(S1)/AD58 designated by ⓝ should be upper 2 digits of 3 hexadecimal digits.
Example) If the AD57(S1)/AD58 is assigned to X,Y120 to 13F, set "12_H" at ⓝ.

(3) The VRAM address to be designated by (S1) can be set within the range of 0 to 7679.
(See Section 1.1.1 for detail of the VRAM areas.)

(4) The number of characters to be designated by (S2) can be set at any number of characters stored at addresses beginning with the address designated by (S1) up to address 7679.
However, a value which exceeds the last device number of the devices designated by (S3) cannot be set.

(5) The ASCII codes to be stored in the devices designated by (S3) can be set in the range of 00_H to FF_H.

(6) If the range of the number of characters designated by (S2) beginning with the address designated by (S1) exceeds address 7679, an error occurs and processing is not performed. Such range setting is ignored.

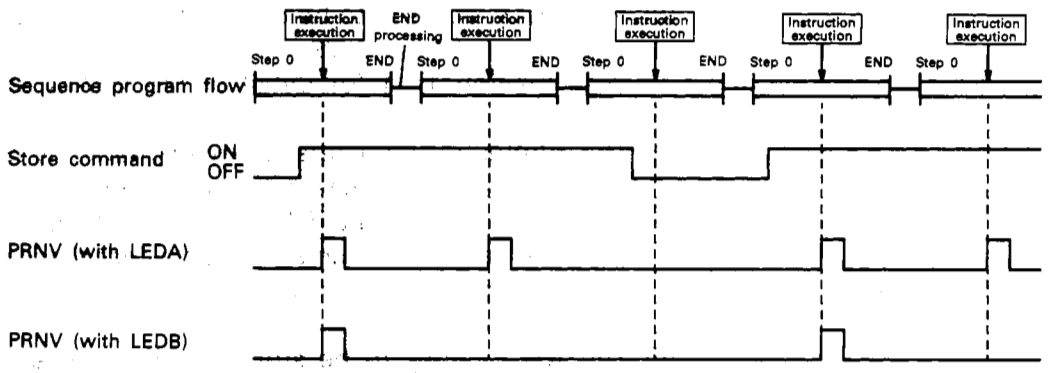
(7) If characters are stored in the areas currently being displayed, such characters are displayed on the screen.

(8) After execution of the PRNV instruction, conditions of the display become as follows.

Item	Condition
Display mode	(no change)
Cursor line position	
Cursor column position	
Head VRAM address displayed	
Normal/reverse designation	
Color designation	
Cursor display	

EXECUTION CONDITION

The PRNV instruction is executed every scan while the store command is ON when the LEDA instruction is used. It is executed only once at the leading edge of the store command signal when the LEDB instruction is used.



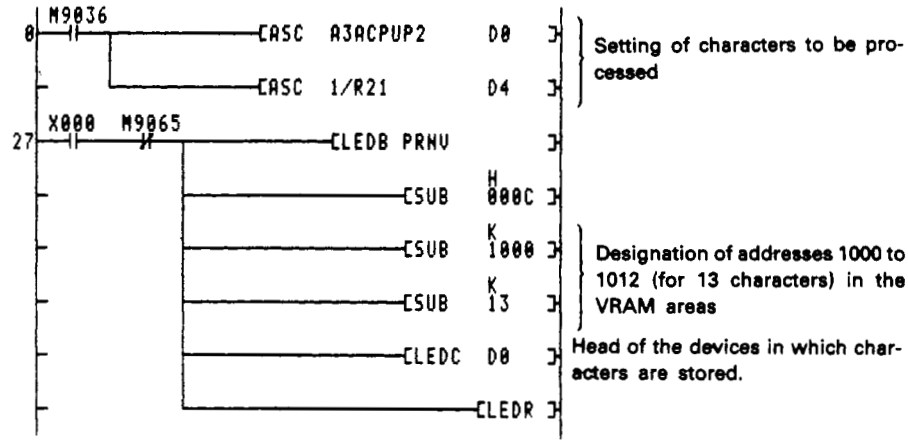
OPERATION ERROR

In the following cases, an operation error occurs and an error flag (M9011) is set.

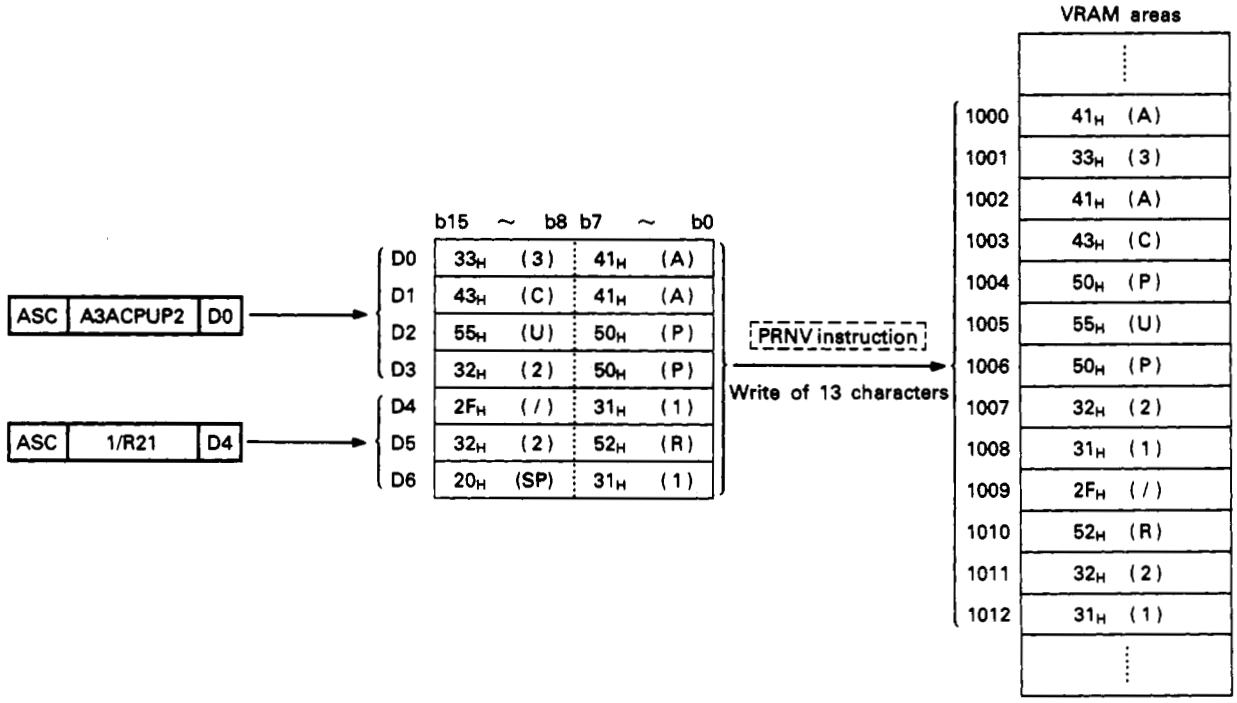
Description	Error Code	
	D9008	D9091
The VRAM area address designated by (S1) is out of the range of 0 to 7679.	50	504
The number of characters designated by (S2) is 0 or a negative value.		
The range of the number of characters designated by (S2) beginning with the device number designated by (S3) exceeds the last device number of corresponding device.		
The range of the number of characters designated by (S2) beginning with the VRAM area address designated by (S1) exceeds address 7679.		

PROGRAM EXAMPLE

The following is an example of the program used to store characters "A3ACPUP21/R21" at address 1000 and after in the VRAM areas of the AD57 loaded at X/Y0C0 to 0FF.
Characters "A3ACPUP21/R21" are stored in the VRAM areas by turning on X000.


0 M9036
CASC A3ACPUP2 D0
CASC 1/R21 D4
Setting of characters to be processed
27 X000 M9065
CLEDB PRNV
CSUB H 000C
CSUB K 1000
CSUB K 13
Designation of addresses 1000 to 1012 (for 13 characters) in the VRAM areas
CLEDC D0
Head of the devices in which characters are stored.
CLEDR

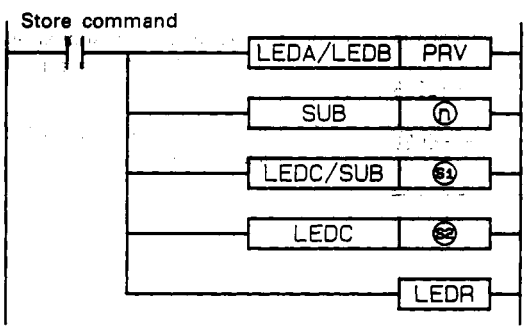
The ASCII instruction is used to convert characters to be displayed (A3ACPUP21/R21) to the ASCII codes. Converted ASCII codes are stored in D0 to D6.
By setting the head of the VRAM addresses to be displayed at address 1000 or before by use of the CPS2 instruction, the character store operation can be monitored on the display unit.



6.5.4 Store of the ASCII characters of designated number of characters up to code 00_H in the VRAM areas·····PRV

	Usable devices																				Digit specification	Number of steps	Subset	Index	Carry flag	Error flag
	Bit device							Word (16-bit) device									Constant		Pointer		Level					
	X	Y	M	L	S	B	F	T	C	D	W	R	A0	A1	Z	V	K	H	P	I	N					M9012	M9011
ⓝ																	○	○									
(S1)								○	○	○	○	○					○	○					23		○		○
(S2)								○	○	○	○	○															

*1: The number of steps varies with type of device used. See Section 5.2.



LEDA : Execution at ON
LEDB : Execution at leading edge

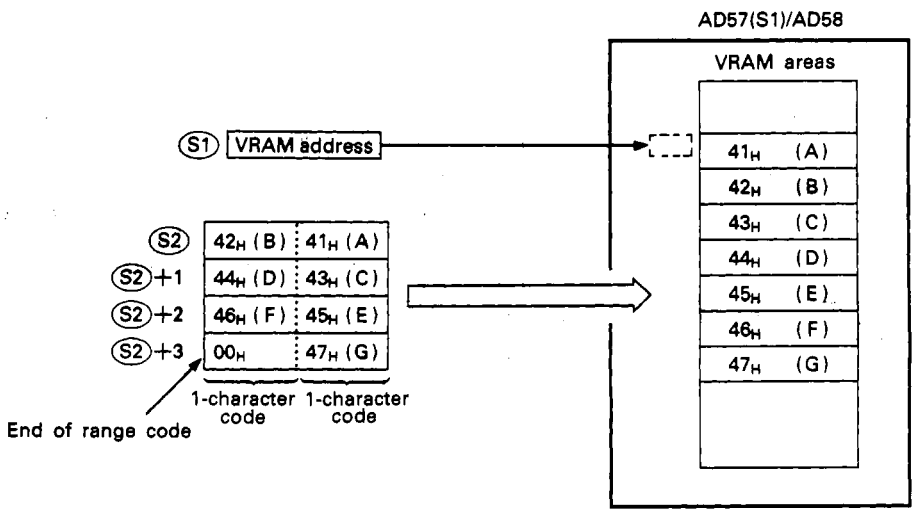
LEDC : Device number is designated
SUB : Constant is designated

Setting data

ⓝ	Head I/O number of AD57
(S1)	Head address of the VRAM areas where the ASCII characters are to be stored
(S2)	Head number of the devices in which the ASCII codes for the characters to be stored are stored.

FUNCTION

(1) The PRV instruction is used to store designated ASCII characters in the VRAM areas of the AD57(S1)/AD58 designated by ⓝ beginning with the address designated by (S1).
The ASCII characters to be stored correspond to the ASCII codes which are stored in the devices beginning with the device number designated by (S2) up to the device in which code "00_H" is stored.



(2) The head I/O number of the AD57(S1)/AD58 designated by ⓝ should be upper 2 digits of 3 hexadecimal digits.
Example) If the AD57(S1)/AD58 is assigned to X.Y120 to 13F, set "12_H" at ⓝ.

(3) The VRAM address to be designated by (S1) can be set within the range of 0 to 7679.
(See Section 1.1.1 for detail of the VRAM areas.)

(4) The ASCII codes to be stored in the devices designated by (S2) can be set in the range of 01_H to FF_H.
Since code "00_H" designates the end of the range of characters to be displayed, it cannot be set as an ASCII code.

(5) The number of characters which can be stored by one time of processing equals to the number of characters from the address designated by (S1) up to address 7679.

(6) If the range of the number of characters beginning with the address designated by (S1) exceeds address 7679, an error occurs and processing is not performed.

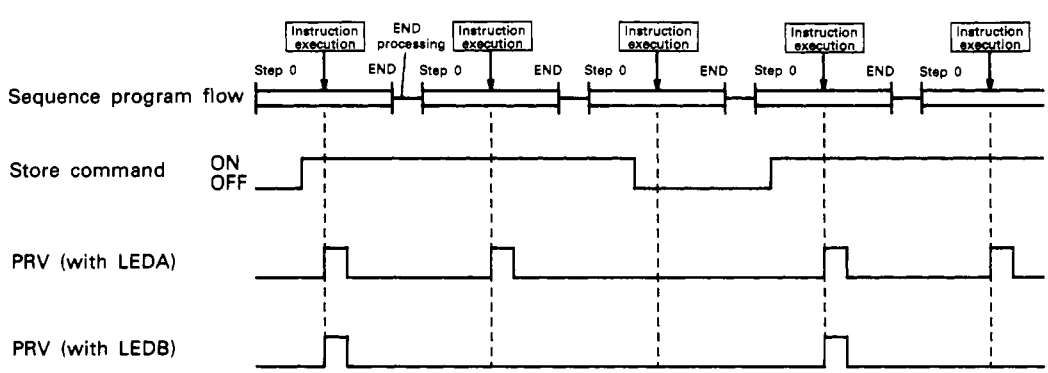
(7) If characters are stored in the areas currently being displayed, such characters are displayed on the screen.

(8) After execution of the PRV instruction, conditions of the display become as follows.

Item	Condition
Display mode	(no change)
Cursor line position	
Cursor column position	
Head VRAM address displayed	
Normal/reverse designation	
Color designation	
Cursor display	Not displayed

EXECUTION CONDITION

The PRV instruction is executed every scan while the store command is ON when the LEDA instruction is used. It is executed only once at the leading edge of the store command signal when the LEDB instruction is used.



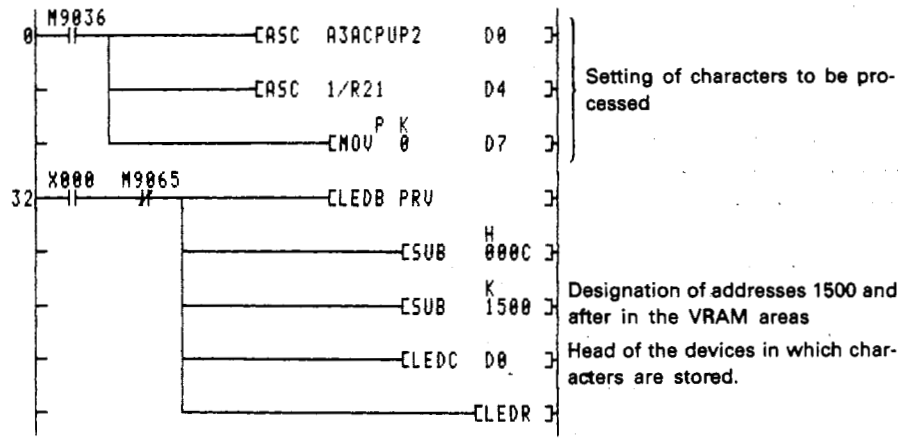
OPERATION ERROR

In the following cases, an operation error occurs and an error flag (M9011) is set.

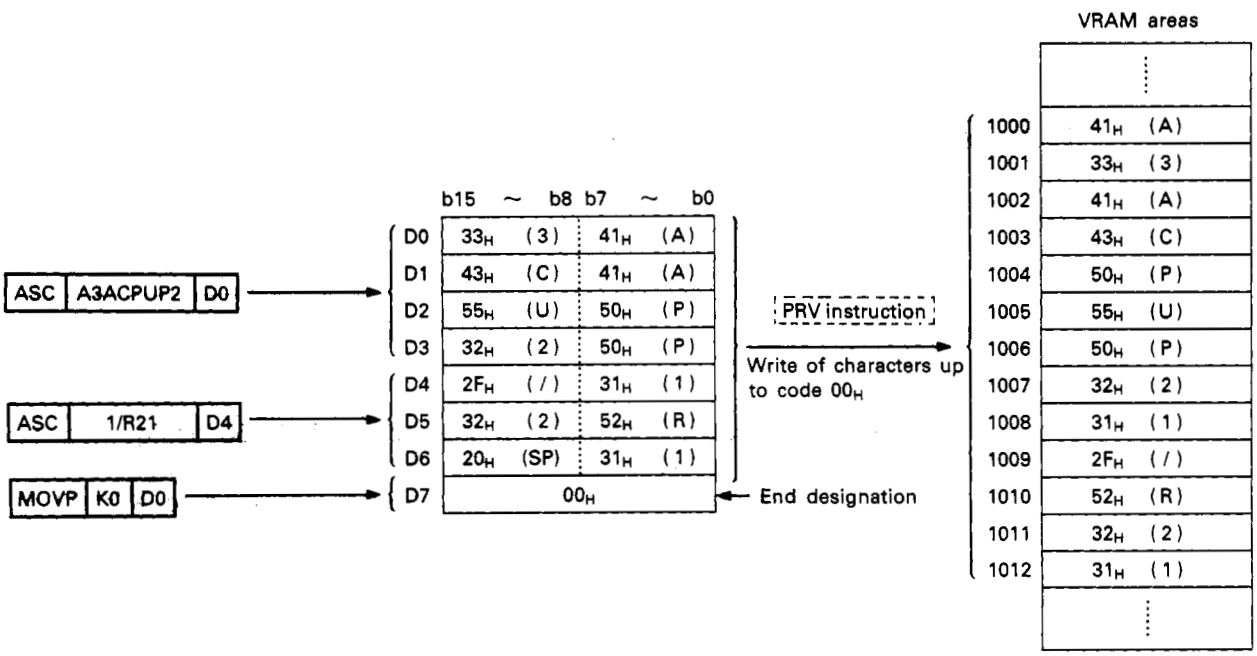
Description	Error Code	
	D9008	D9091
The VRAM area address designated by (S1) is out of the range of 0 to 7679.	50	504
Code 00_H is not provided between the device number designated by (S2) and the last device number of corresponding device.		
The range of the number of characters to be stored beginning with the VRAM area address designated by (S1) exceeds address 7679.		
The number of characters to be stored is 0.		

PROGRAM EXAMPLE

The following is an example of the program used to store characters "A3ACPUP21/R21" at address 1000 and after in the VRAM areas of the AD57 loaded at X/Y0C0 to 0FF.
Characters "A3ACPUP21/R21" are stored in the VRAM areas by turning on X000.



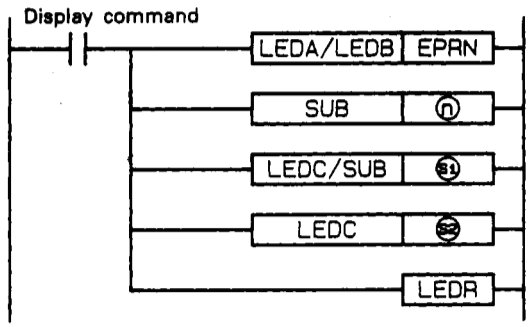
The ASCII instruction is used to convert characters to be displayed (A3ACPUP21/R21) to the ASCII codes. Converted ASCII codes are stored in D0 to D6.
"0" is stored in D7 to designate the end of the range of characters to be displayed.
By setting the head of the VRAM addresses to be displayed at address 1000 or before by use of the CPS2 instruction, the character store operation can be monitored on the display unit.



6.5.5 Display of designated number of designated characters·····EPRN

	Usable devices																				Digit specification	Number of steps	Subset	Index	Carry flag	Error flag
	Bit device							Word (16-bit) device									Constant		Pointer		Level						
	X	Y	M	L	S	B	F	T	C	D	W	R	A0	A1	Z	V	K	H	P	I	N					M9012	M9011
ⓝ																	○	○									
(S1)								○	○	○	○	○					○	○					23		○		○
(S2)								○	○	○	○	○															

*1: The number of steps varies with type of device used. See Section 5.2.



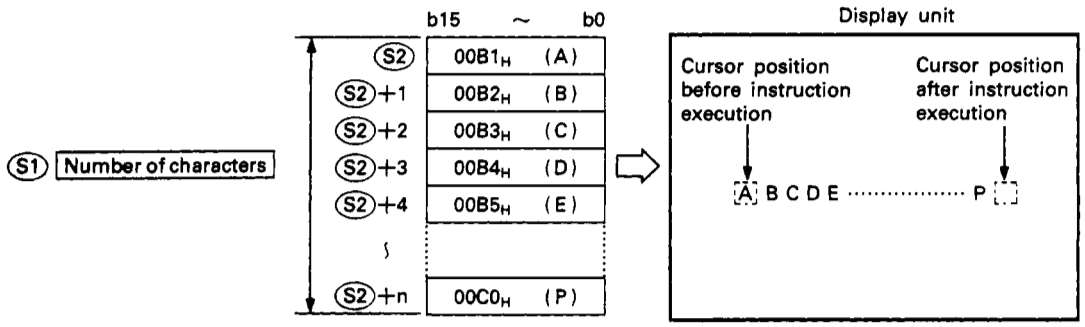
LEDA : Execution at ON
LEDB : Execution at leading edge
LEDC : Device number is designated
SUB : Constant is designated

Setting data

ⓝ	Head I/O number of AD57
(S1)	Number of characters to be displayed
(S2)	Head number of the devices in which the ASCII codes for the characters to be displayed are stored.

FUNCTION

(1) The EPRN instruction is used to display designated ASCII characters beginning with current cursor position on the display unit of the AD57(S1)/AD58 designated by ⓝ.
The characters to be displayed correspond to the ASCII codes which are stored in the devices which correspond to the number of characters designated by (S1) beginning with the device number designated by (S2).

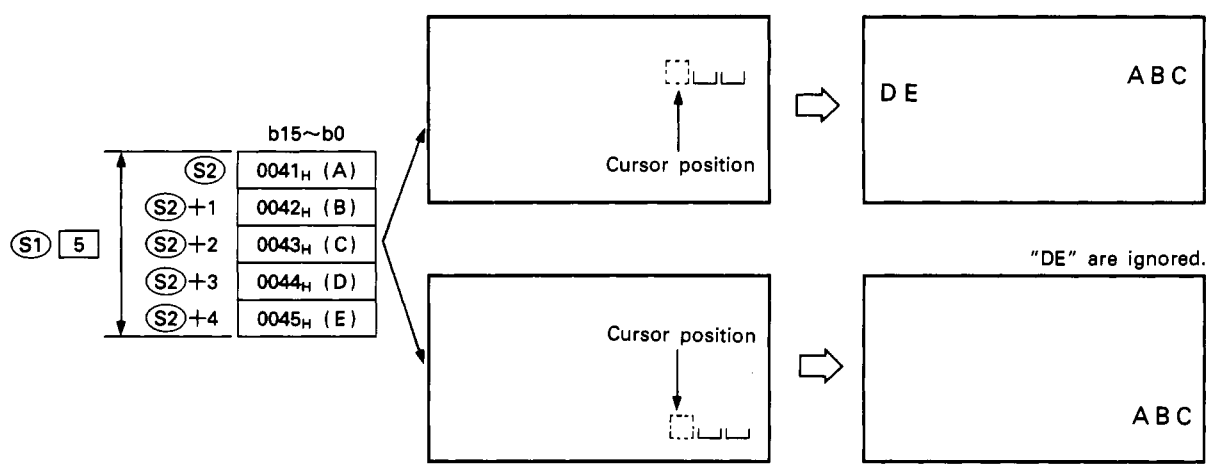


(2) The head I/O number of the AD57(S1)/AD58 designated by ⓝ should be upper 2 digits of 3 hexadecimal digits.
Example) If the AD57(S1)/AD58 is assigned to X.Y120 to 13F, set "12_H" at ⓝ.

(3) The number of characters designated by (S1) can be selected from 1 to the total number of characters beginning with the cursor position to the last column on the last line on the screen.
However, the number of characters to be designated should not exceed the value specified by the last device which is designated by (S2).

(4) The ASCII codes to be stored in the devices designated by (S2) can be set in the range of 0000_H to $03FF_H$.
If code 0400H or a higher code number is set, it is processed as code 0020_H (space code).

(5) If the range of the number of characters designated by (S1) beginning with the cursor position exceeds the last column on a line, the excess range laps around to column 0 on the next line.
If the designated range exceeds the last column of the last line on the screen, characters up to the last column on the last line are displayed. The excess characters are ignored.

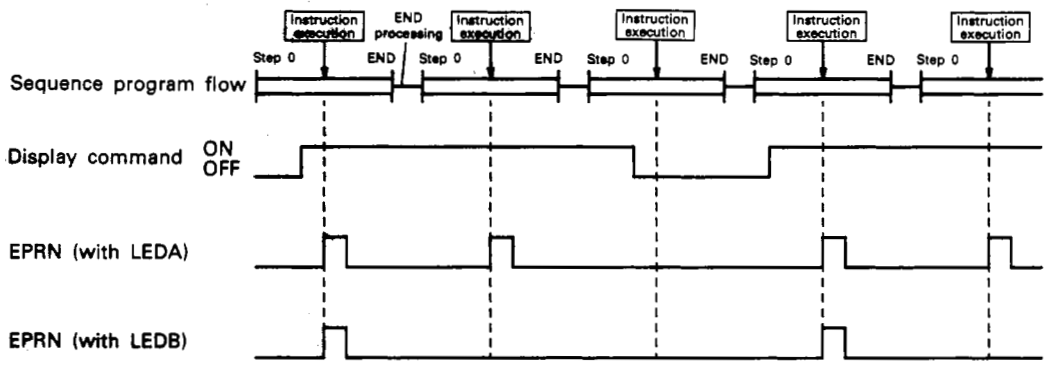


(7) After execution of the EPRN instruction, conditions of the display become as follows.

Item	Condition
Display mode	(no change)
Cursor line position	Plus one line if the designated range exceeds the last column.
Cursor column position	Current cursor position plus designated number of characters
Head VRAM address displayed	(no change)
Normal/reverse designation	
Color designation	
Cursor display	

EXECUTION CONDITION

The EPRN instruction is executed every scan while the display command is ON when the LEDA instruction is used. It is executed only once at the leading edge of the display command signal when the LEDB instruction is used.



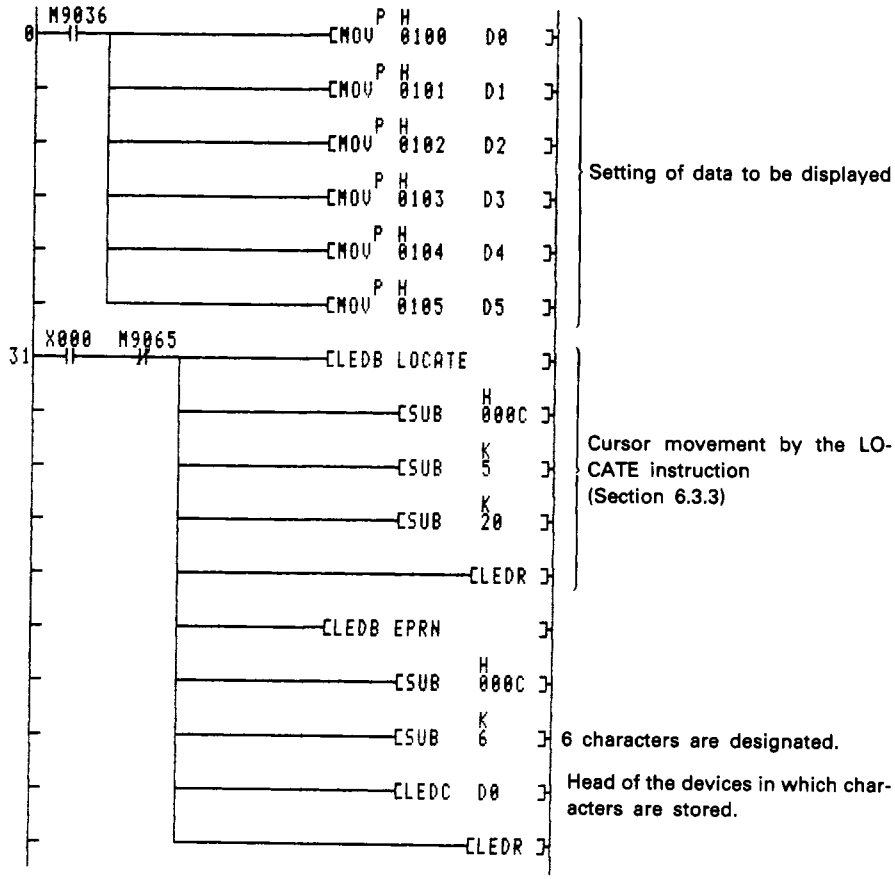
OPERATION ERROR

In the following cases, an operation error occurs and an error flag (M9011) is set.

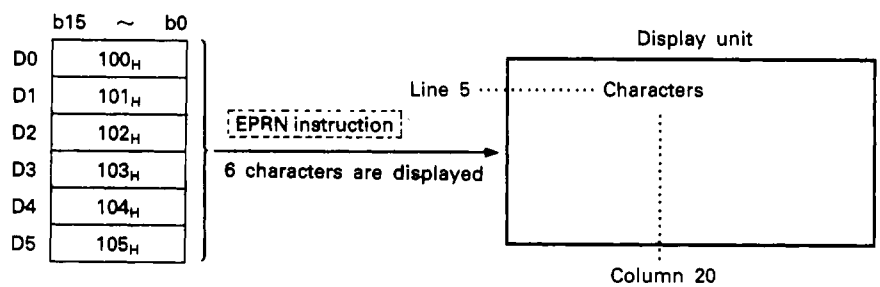
Description	Error Code	
	D9008	D9091
The range of the number of characters designated by (S1) beginning with the device number designated by (S2) exceeds the last device number of corresponding device.	50	504
The number of characters designated by (S1) is 0 or a negative value.		

PROGRAM EXAMPLE

The following is an example of the program used to display characters which correspond to character codes 100_H to 105_H beginning with column 20 on line 5 on a display unit connected to the AD57 loaded at X/Y0C0 to 0FF.
Characters are displayed by turning on X000.



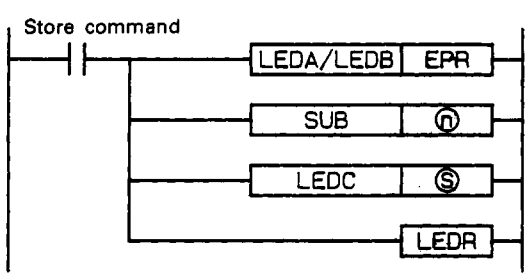
The character codes which correspond to the characters to be displayed are stored in D0 to D5.



6.5.6 Display of designated characters up to code 00_H·····EPR

	Usable devices																				Digit specification	Number of steps	Subset	Index	Carry flag	Error flag
	Bit device							Word (16-bit) device									Constant		Pointer		Level						
	X	Y	M	L	S	B	F	T	C	D	W	R	A0	A1	Z	V	K	H	P	I	N					M9012	M9011
ⓝ																	○	○					20		○		○
Ⓢ									○	○	○	○	○														

*1: The number of steps varies with type of device used. See Section 5.2.



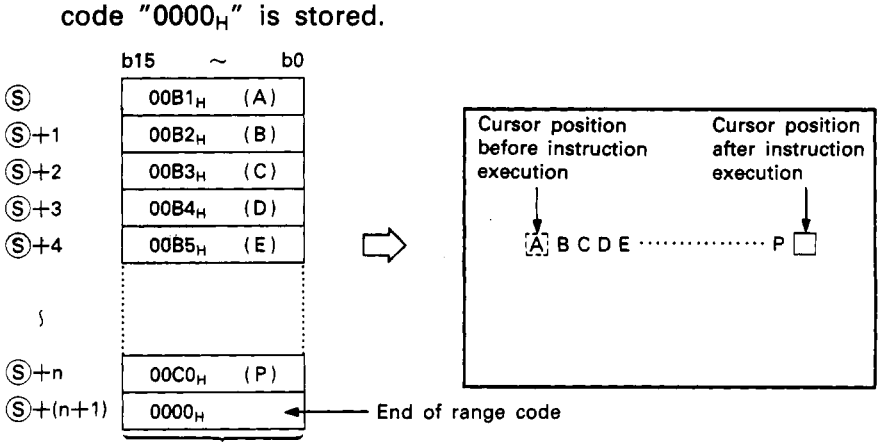
LEDA : Execution at ON
LEDB : Execution at leading edge

Setting data

ⓝ	Head I/O number of AD57
Ⓢ	Head number of the devices in which character codes for the characters to be displayed are stored.

FUNCTION

(1) The EPR instruction is used to display designated characters beginning with current cursor position on the display unit of the AD57(S1)/AD58 designated by ⓝ.
The characters to be displayed correspond to the character codes which are stored in the devices beginning with the device number designated by Ⓢ up to the device in which code "0000_H" is stored.

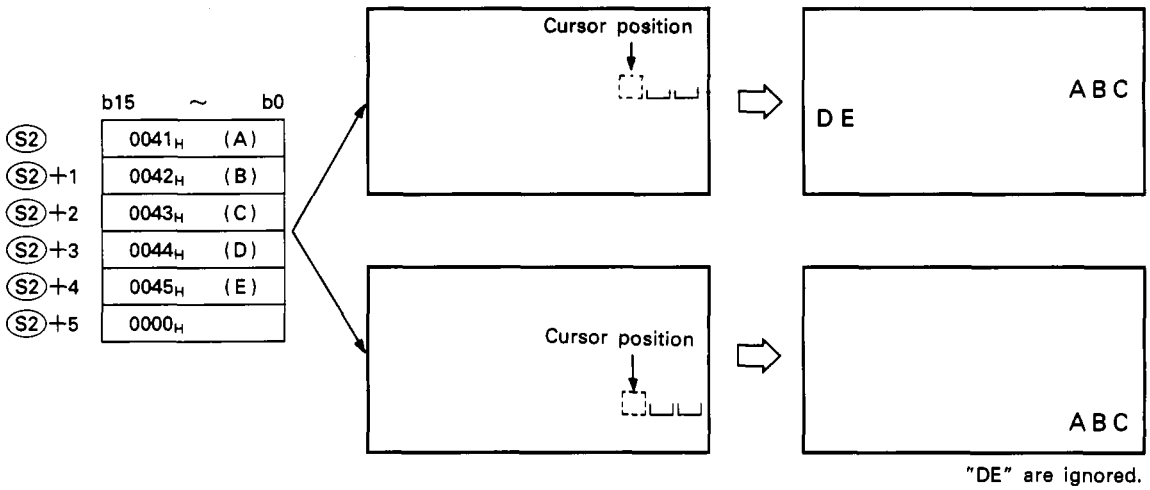


(2) The head I/O number of the AD57(S1)/AD58 designated by ⓝ should be upper 2 digits of 3 hexadecimal digits.
Example) If the AD57(S1)/AD58 is assigned to X.Y120 to 13F, set "12_H" at ⓝ.

(3) The character codes to be stored in the devices designated by Ⓢ can be set in the range of 0001_H to $03FF_H$.
Since code "0000_H" designates the end of the range of characters to be displayed, it cannot be set as a character code.
If code "0400_H" or a higher code is set, it is processed as code "0020_H".

(4) The number of characters which can be displayed by one time of processing equals to the number of characters from the cursor position to the last column on the last line on the screen.

(5) If the range of the number of characters beginning with the cursor position exceeds the last column on a line, the excess range laps around to column 0 on the next line.
If the designated range exceeds the last column of the last line on the screen, characters up to the last column on the last line are displayed. The excess characters are ignored.

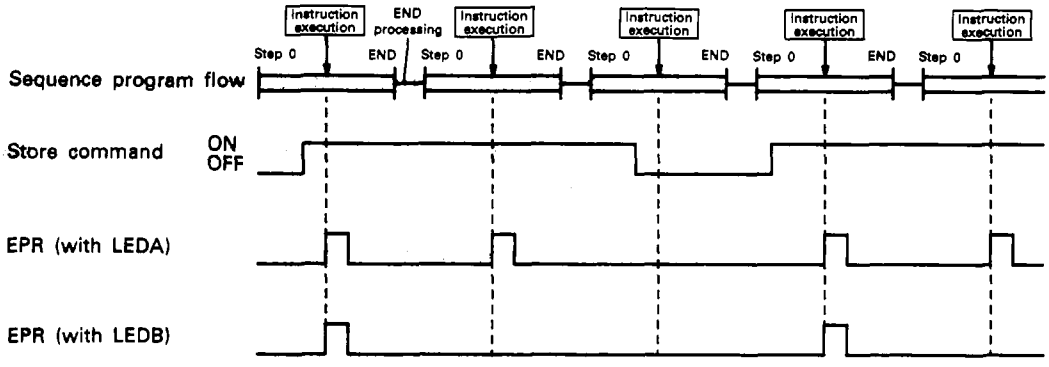


(6) After execution of the EPR instruction, conditions of the display become as follows.

Item	Condition
Display mode	(no change)
Cursor line position	Plus one line if the designated range exceeds the last column.
Cursor column position	Current cursor position plus designated number of characters
Head VRAM address displayed	(no change)
Normal/reverse designation	
Color designation	
Cursor display	

EXECUTION CONDITION

The EPR instruction is executed every scan while the store command is ON when the LEDA instruction is used. It is executed only once at the leading edge of the store command signal when the LEDB instruction is used.



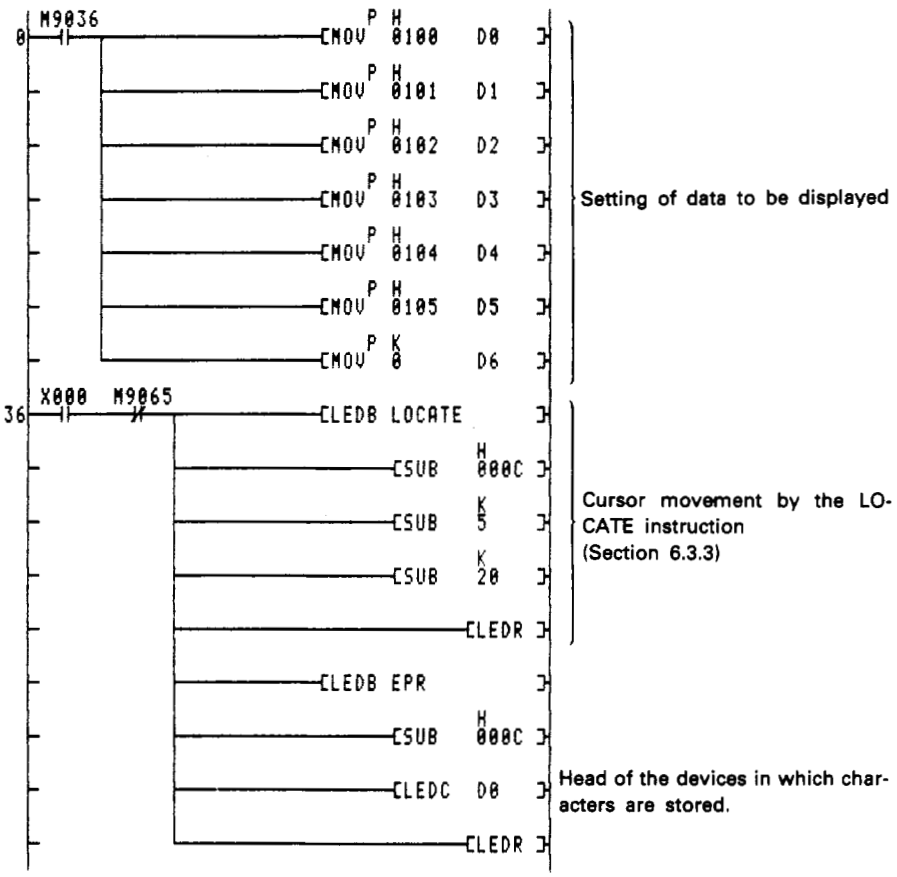
OPERATION ERROR

In the following cases, an operation error occurs and an error flag (M9011) is set.

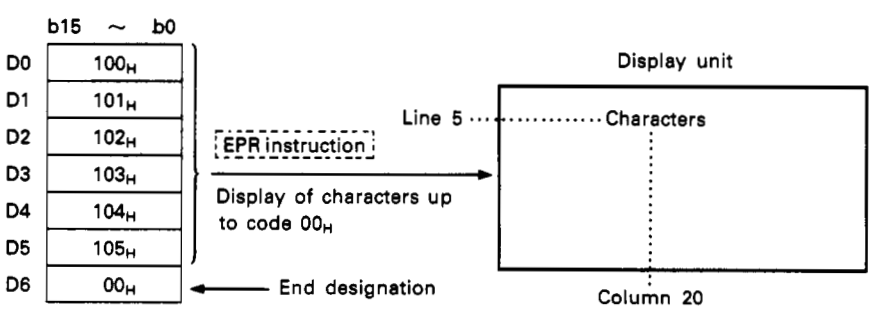
Description	Error Code	
	D9008	D9091
Code 00_H is not provided between the device number designated by Ⓢ and the last device number of corresponding device.	50	504
The number of characters to be displayed is 0.		

PROGRAM EXAMPLE

The following is an example of the program used to display characters which correspond to character codes 100_H to 105_H beginning with column 20 and after on line 5 on a display unit connected to the AD57 loaded at X/Y0C0 to 0FF.
Characters are displayed by turning on X000.



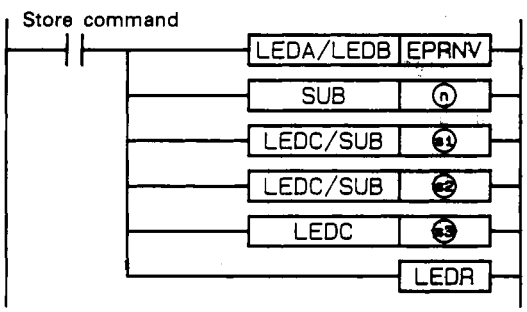
The character codes which correspond to the characters to be displayed are stored in D0 to D5.
"0" is stored in D6 to designate the end of the range of characters to be displayed.



6.5.7 Store of designated number of designated characters in the VRAM areas·····EPRNV

	Usable devices																				Digit specification	Number of steps	Subset	Index	Carry flag	Error flag
	Bit device							Word (16-bit) device									Constant		Pointer		Level						
	X	Y	M	L	S	B	F	T	C	D	W	R	A0	A1	Z	V	K	H	P	I	N					M9012	M9011
ⓝ																	○	○									
(S1)								○	○	○	○	○					○	○					26		○		○
(S2)								○	○	○	○	○					○	○									
(S3)								○	○	○	○	○															

*1: The number of steps varies with type of device used. See Section 5.2.

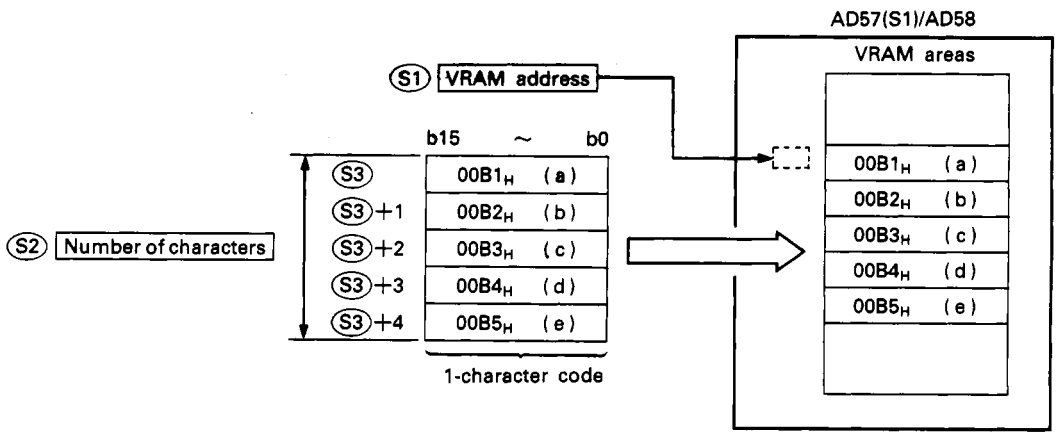


Setting data

ⓝ	Head I/O number of AD57
(S1)	Head address of the VRAM areas where characters are to be stored
(S2)	Number of characters to be stored
(S3)	Head number of the devices in which character codes for the characters to be stored are stored.

FUNCTION

(1) The EPRNV instruction is used to store designated characters in the VRAM areas of the AD57(S1)/AD58 designated by ⓝ beginning with the address designated by (S1).
The characters to be stored correspond to the character codes which are stored in the devices which correspond to the number of characters designated by (S2) beginning with the device number designated by (S3).



(2) The head I/O number of the AD57(S1)/AD58 designated by ⓝ should be upper 2 digits of 3 hexadecimal digits.
Example) If the AD57(S1)/AD58 is assigned to X.Y120 to 13F, set "12H" at ⓝ.

(3) The VRAM address to be designated by (S1) can be set within the range of 0 to 7679.
(See Section 1.1.1 for detail of the VRAM areas.)

(4) The number of characters to be designated by (S2) can be set at any number of characters stored at addresses beginning with the address designated by (S1) up to address 7679.
However, a value which exceeds the last device number of the devices designated by (S3) cannot be set.

(5) The character codes to be stored in the devices designated by (S2) can be set in the range of 0000_H to $03FF_H$.
If code "0400_H" or a higher code is set, it is processed as code "0020_H" (space code).

(6) If the range of the number of characters designated by (S2) beginning with the address designated by (S1) exceeds address 7679, an error occurs and processing is not performed.

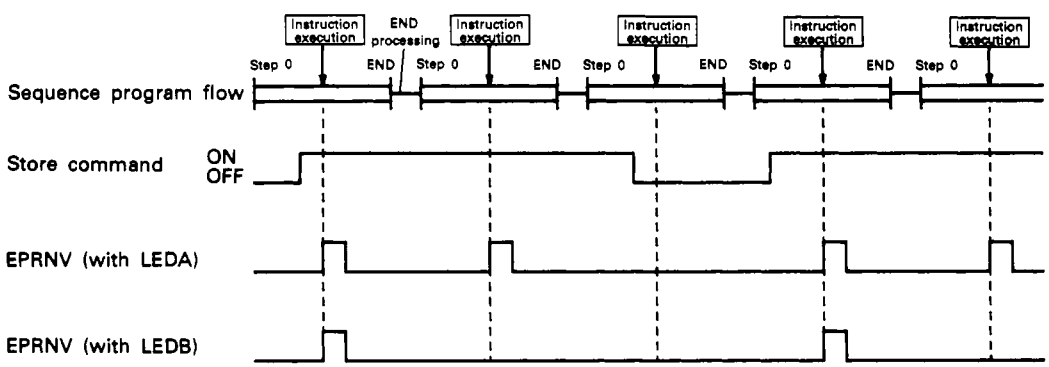
(7) If characters are stored in the areas currently being displayed, such characters are displayed on the screen.

(8) After execution of the EPRNV instruction, conditions of the display become as follows.

Item	Condition
Display mode	(no change)
Cursor line position	
Cursor column position	
Head VRAM address displayed	
Normal/reverse designation	
Color designation	
Cursor display	

EXECUTION CONDITION

The EPRNV instruction is executed every scan while the store command is ON when the LEDA instruction is used. It is executed only once at the leading edge of the store command signal when the LEDB instruction is used.



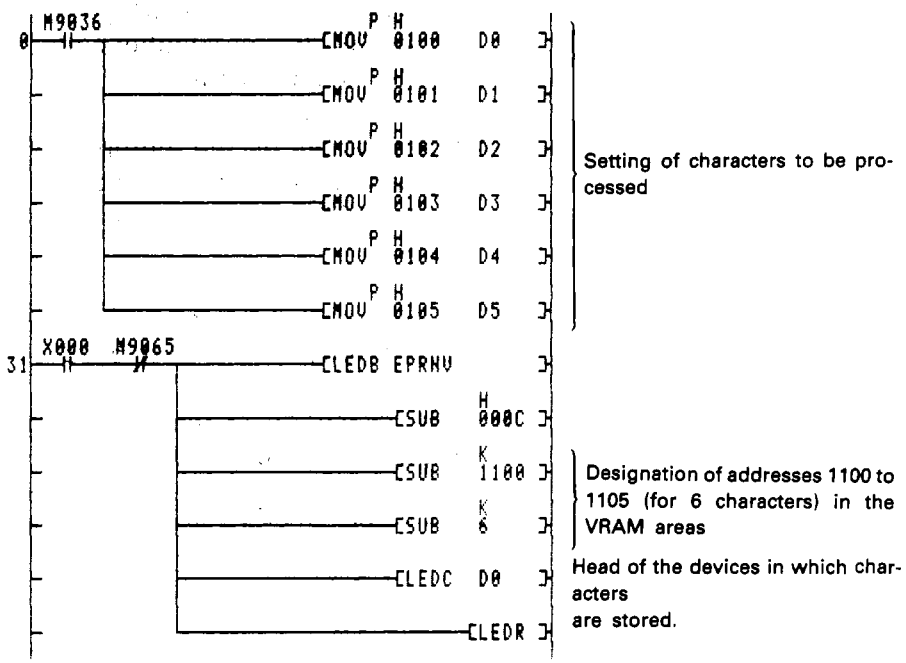
OPERATION ERROR

In the following cases, an operation error occurs and an error flag (M9011) is set.

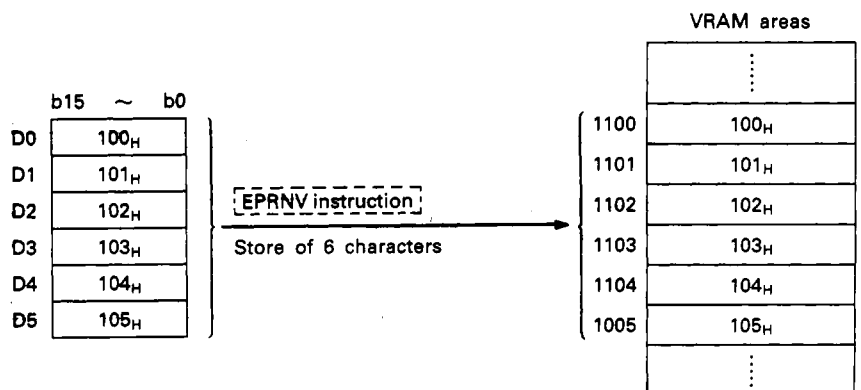
Description	Error Code	
	D9008	D9091
The VRAM area address designated by (S1) is out of the range of 0 to 7679.	50	504
The number of characters designated by (S2) is 0 or a negative value.		
The range of the number of characters designated by (S2) beginning with the device number designated by (S3) exceeds the last device number of corresponding device.		
The range of the number of characters designated by (S2) beginning with the VRAM area address designated by (S1) exceeds address 7679.		

PROGRAM EXAMPLE

The following is an example of the program used to store characters which correspond to character codes 100H to 105H beginning with address 1000 in the VRAM areas of the AD57 loaded at X/Y0C0 to 0FF.
Characters are stored in the VRAM areas by turning on X000.


M9036
CMOV P H 0100 D0
CMOV P H 0101 D1
CMOV P H 0102 D2
CMOV P H 0103 D3
CMOV P H 0104 D4
CMOV P H 0105 D5
Setting of characters to be processed
X000 M9065
CLEDB EPRNV
CSUB H 000C
CSUB K 1100
CSUB K 6
Designation of addresses 1100 to 1105 (for 6 characters) in the VRAM areas
CLEDC D0
Head of the devices in which characters are stored.
CLEDR

The character codes which correspond to the characters to be stored are stored in D0 to D5.
By setting the head of the VRAM addresses to be displayed at address 1000 or before by use of the CPS2 instruction, the character store operation can be monitored on the display unit.

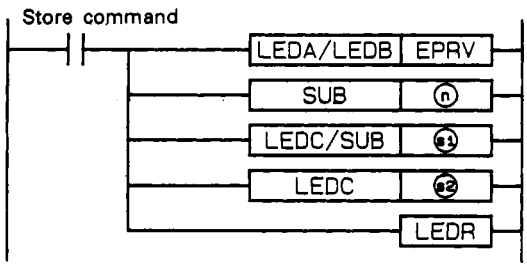


MEMO

6.5.8 Store of designated characters up to code 00_H in the VRAM areas·····EPRV

	Usable devices																				Digit specification	Number of steps	Subset	Index	Carry flag	Error flag
	Bit device							Word (16-bit) device									Constant		Pointer		Level					
	X	Y	M	L	S	B	F	T	C	D	W	R	A0	A1	Z	V	K	H	P	I	N					M9012	M9011
ⓝ																	○	○									
(S1)								○	○	○	○	○					○	○					23		○		○
(S2)								○	○	○	○	○															

*1: The number of steps varies with type of device used. See Section 5.2.



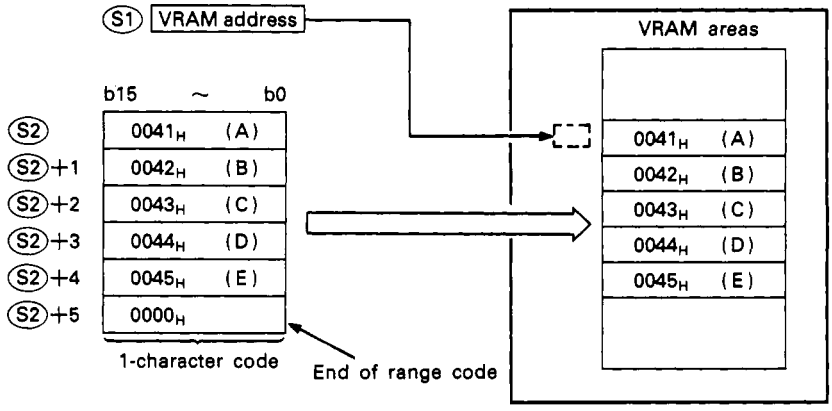
LEDA : Execution at ON
LEDB : Execution at leading edge
LEDC : Device number is designated
SUB : Constant is designated

Setting data

ⓝ	Head I/O number of AD57
(S1)	Head address of the VRAM areas where characters are to be stored.
(S2)	Head number of the devices in which character codes for the characters to be stored are stored.

FUNCTION

(1) The EPRV instruction is used to store designated characters in the VRAM areas of the AD57(S1)/AD58 designated by ⓝ beginning with the address designated by (S1).
The characters to be stored correspond to the character codes which are stored in the devices beginning with the device number designated by (S2) up to the device in which code "00_H" is stored.



(2) The head I/O number of the AD57(S1)/AD58 designated by ⓝ should be upper 2 digits of 3 hexadecimal digits.
Example) If the AD57(S1)/AD58 is assigned to X.Y120 to 13F, set "12_H" at ⓝ.

(3) The VRAM address to be designated by (S1) can be set within the range of 0 to 7679.
(See Section 1.1.1 for detail of the VRAM areas.)

(4) The character codes to be stored in the devices designated by Ⓢ can be set in the range of 0001_H to $03FF_H$.
Since code "0000_H" designates the end of the range of characters to be displayed, it cannot be set as a character code.
If code "0400_H" or a higher code is set, it is processed as code "0020_H" (space code).

(5) The number of characters which can be stored by one time of processing equals to the number of characters from the address designated by Ⓢ1 up to address 7679.

(6) If the range of the number of characters beginning with the address designated by Ⓢ1 exceeds address 7679, an error occurs and processing is not performed.

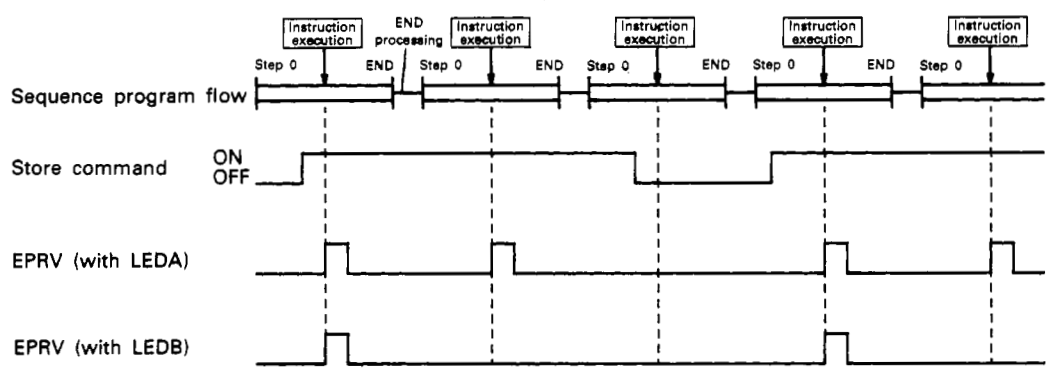
(7) If characters are stored in the areas currently being displayed, such characters are displayed on the screen.

(8) After execution of the EPRV instruction, conditions of the display become as follows.

Item	Condition
Display mode	(no change)
Cursor line position	
Cursor column position	
Head VRAM address displayed	
Normal/reverse designation	
Color designation	
Cursor display	

EXECUTION CONDITION

The EPRV instruction is executed every scan while the store command is ON when the LEDA instruction is used. It is executed only once at the leading edge of the store command signal when the LEDB instruction is used.



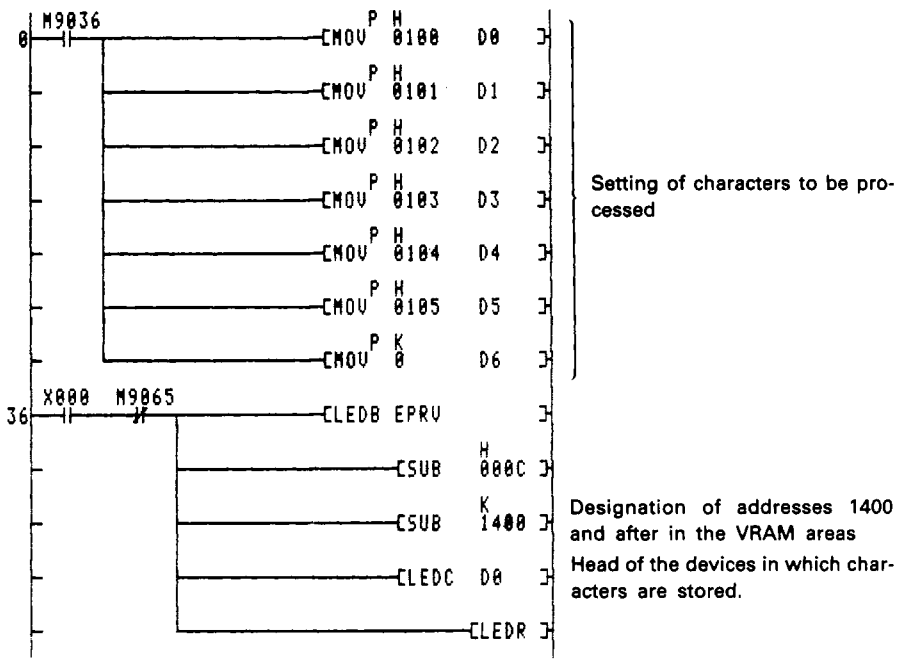
OPERATION ERROR

In the following cases, an operation error occurs and an error flag (M9011) is set.

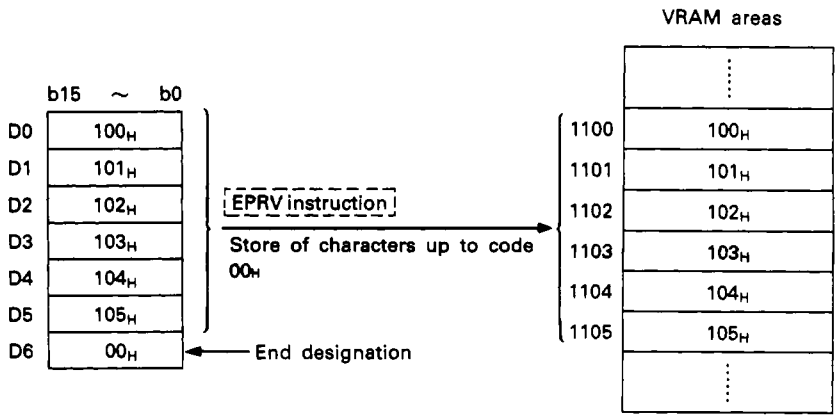
Description	Error Code D9008	Error Code D9091
The VRAM area address designated by Ⓢ1 is out of the range of 0 to 7679.	50	504
Code 00_H is not provided between the device number designated by Ⓢ2 and the last device number of corresponding device.		
The range of the number of characters to be stored beginning with the VRAM area address designated by Ⓢ1 exceeds address 7679.		
The number of characters to be stored is 0.		

PROGRAM EXAMPLE

The following is an example of the program used to store characters which correspond to character codes 100H to 105H at addresses 1000 and after in the VRAM areas of the AD57 loaded at X/Y0C0 to 0FF.
Characters are stored in the VRAM areas by turning on X000.


M9036
0
CMOV P H 0100 D0
CMOV P H 0101 D1
CMOV P H 0102 D2
CMOV P H 0103 D3
CMOV P H 0104 D4
CMOV P H 0105 D5
CMOV P K 0 D6
Setting of characters to be processed
X000 M9065
36
CLEDB EPRV
CSUB H 000C
CSUB K 1400
CLEDC D0
CLEDR
Designation of addresses 1400 and after in the VRAM areas
Head of the devices in which characters are stored.

The character codes which correspond to the characters to be stored are stored in D0 to D5.
"0" is stored in D6 to designate the end of the range of characters to be displayed.
By setting the head of the VRAM addresses to be displayed at address 1000 or before by use of the CPS2 instruction, the character store operation can be monitored on the display unit.

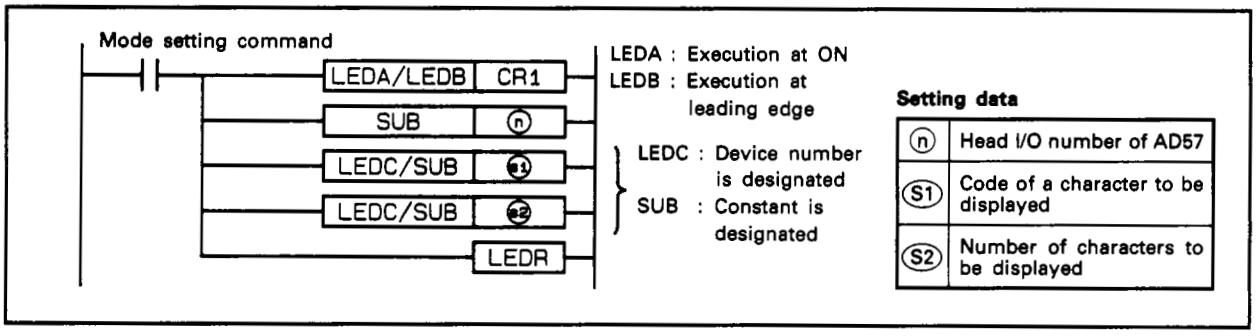


MEMO

6.5.9 Horizontal repeated display of a designated character·····CR1

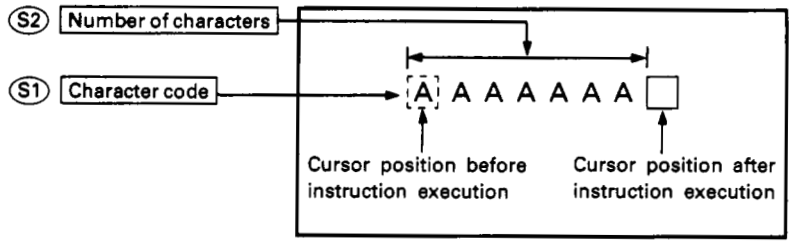
	Usable devices																			Digit specification	Number of steps	Subset	Index	Carry flag	Error flag
	Bit device							Word (16-bit) device									Constant		Pointer		Level					
	X	Y	M	L	S	B	F	T	C	D	W	R	A0	A1	Z	V	K	H	P	I	N				M9012	M9011
(n)																	○	○								
(S1)								○	○	○	○	○					○	○					23		○		○
(S2)								○	○	○	○	○					○	○								

*1: The number of steps varies with type of device used. See Section 5.2.



FUNCTION

(1) The CR1 instruction is used to display a designated character which correspond to the character code designated by (S1) for the number of characters designated by (S2) beginning with current cursor position to the right on the display unit of the AD57(S1)/AD58 designated by (n).


(S2) Number of characters
(S1) Character code
A A A A A A A
Cursor position before instruction execution
Cursor position after instruction execution

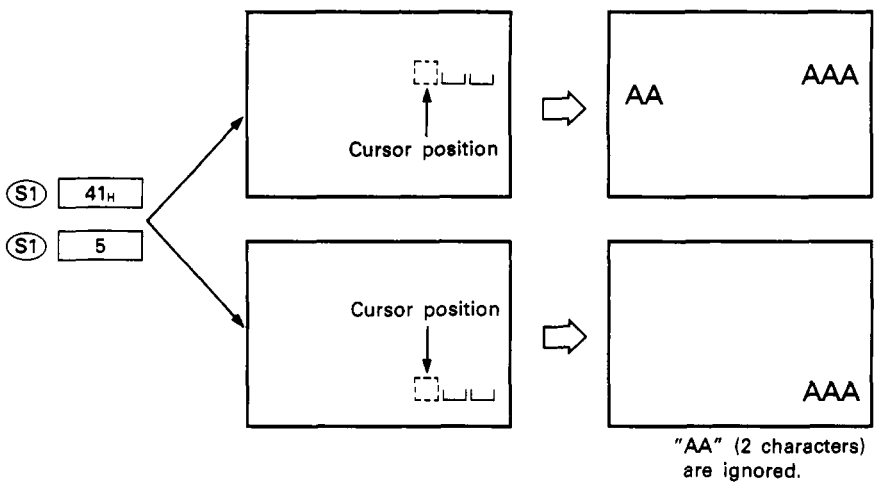
(2) The CR1 instruction is used to display horizontal lines of a table and bar graphs.

(3) The head I/O number of the AD57(S1)/AD58 designated by (n) should be upper 2 digits of 3 hexadecimal digits.
Example) If the AD57(S1)/AD58 is assigned to X.Y120 to 13F, set "12$_H$" at (n).

(4) The character code designated by (S1) can be set within the range of 00$_H$ to 3FF$_H$.
If code 400$_H$ or higher is designated, an error occurs.

(5) The number of characters designated by (S2) can be set within the range of 1 to 80.

(6) If the range of the number of characters designated by (S2) beginning with the cursor position exceeds the last column on a line, the excess range of characters laps around to column 0 on the next line.
If the designated range exceeds the last column of the last line on the screen, characters up to the last column on the last line are displayed. The excess characters are ignored.

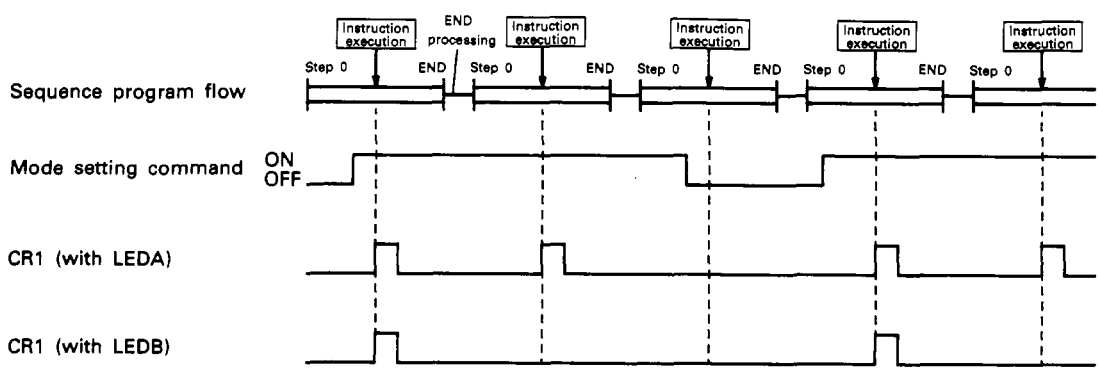


(7) After execution of the CR1 instruction, conditions of the display become as follows.

Item	Condition
Display mode	(no change)
Cursor line position	Plus one line if the designated range exceeds the last column.
Cursor column position	Current cursor position plus designated number of characters
Head VRAM address displayed	(no change)
Normal/reverse designation	
Color designation	
Cursor display	

EXECUTION CONDITION

The CR1 instruction is executed every scan while the display command is ON when the LEDA instruction is used. It is executed only once at the leading edge of the display command signal when the LEDB instruction is used.



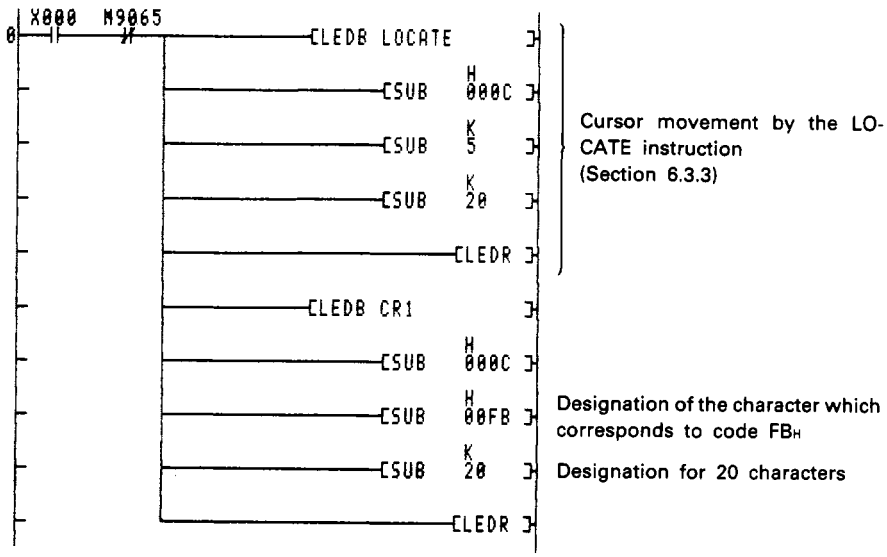
OPERATION ERROR

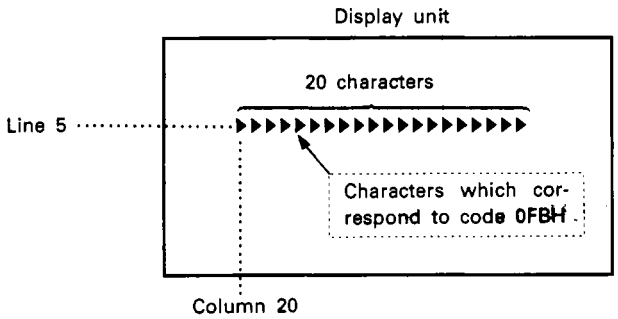
In the following cases, an operation error occurs and an error flag (M9011) is set.

Description	Error Code	
	D9008	D9091
The character code designated by (S1) is out of the range of 0 to 3FF.	50	503
The number of characters designated by (S2) is out of the range of 1 to 80.		

PROGRAM EXAMPLE

The following is an example of the program used to display the character which corresponds to character code 0FBH twenty times horizontally on a display unit connected to the AD57 loaded at X/Y0C0 to 0FF.
A designated character is displayed repeatedly beginning with column 20 on line 5 by turning on X000.



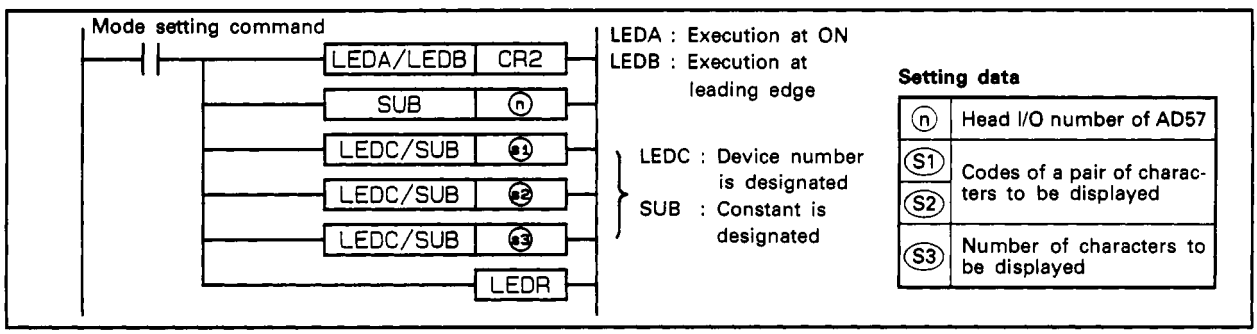


MEMO

6.5.10 Horizontal repeated display of a pair of designated characters·····CR2

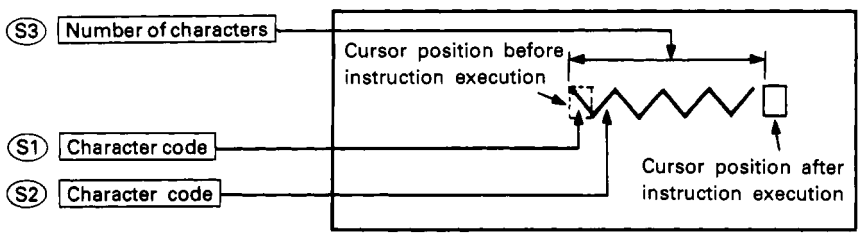
	Usable devices																				Digit specification	Number of steps	Subset	Index	Carry flag	Error flag
	Bit device							Word (16-bit) device									Constant		Pointer		Level					
	X	Y	M	L	S	B	F	T	C	D	W	R	A0	A1	Z	V	K	H	P	I	N					M9012	M9011
ⓝ																	○	○								
(S1)								○	○	○	○	○					○	○								
(S2)								○	○	○	○	○					○	○					26		○	○
(S3)								○	○	○	○	○					○	○								

*1: The number of steps varies with type of device used. See Section 5.2.



FUNCTION

(1) The CR2 instruction is used to display repeatedly a pair of designated characters each of which corresponds to respective character code designated by (S1) and (S2) on a display unit connected to the AD57(S1)/AD58 which is designated by ⓝ.
Repeated display begins with the cursor position and continues horizontally to the right for the number of pairs of characters designated by (S3).


(S3) Number of characters
Cursor position before instruction execution
(S1) Character code
(S2) Character code
Cursor position after instruction execution

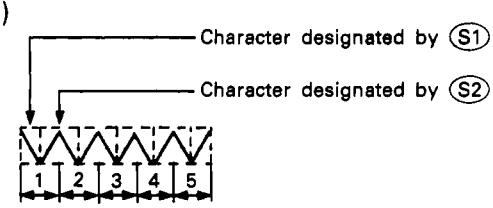
(2) The CR2 instruction is used to display repeatedly on a horizontal line a pair of characters which make one complete figure.

(3) The head I/O number of the AD57(S1)/AD58 designated by ⓝ should be upper 2 digits of 3 hexadecimal digits.
Example) If the AD57(S1)/AD58 is assigned to X.Y120 to 13F, set "12_H" at ⓝ.

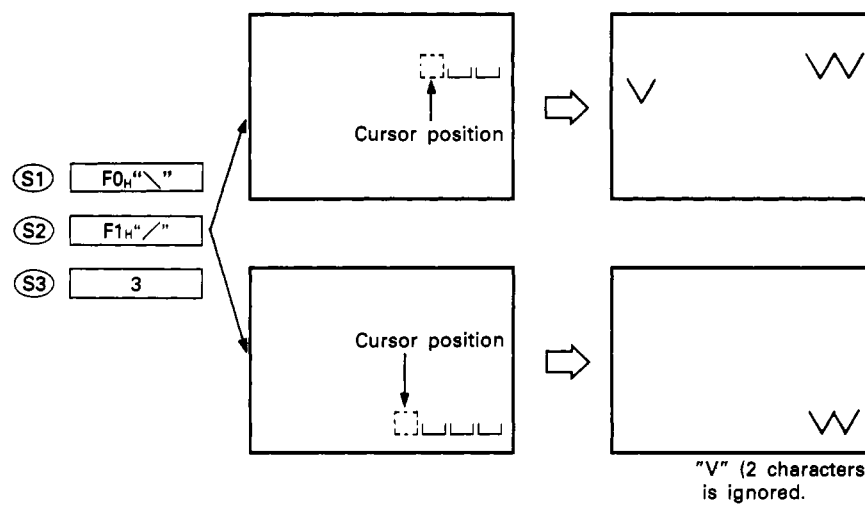
(4) The character codes designated by (S1) and (S2) can be set within the range of 00_H to $3FF_H$.
If code 400_H or higher is designated, an error occurs.

(5) The character code designated by (S1) corresponds to the left half of each pair, and the character code designated by (S2) corresponds to the right half of each pair.

(6) The number of characters designated by (S3) corresponds to the number of pairs of characters which are designated by (S1) and (S2) and can be set within the range of 1 to 40.
Example)



(7) If the range of the number of characters designated by (S3) beginning with the cursor position exceeds the last column on a line, the excess range of characters laps around to column 0 on the next line.
If the designated range exceeds the last column of the last line on the screen, characters up to the last column on the last line are displayed. The excess characters are ignored.

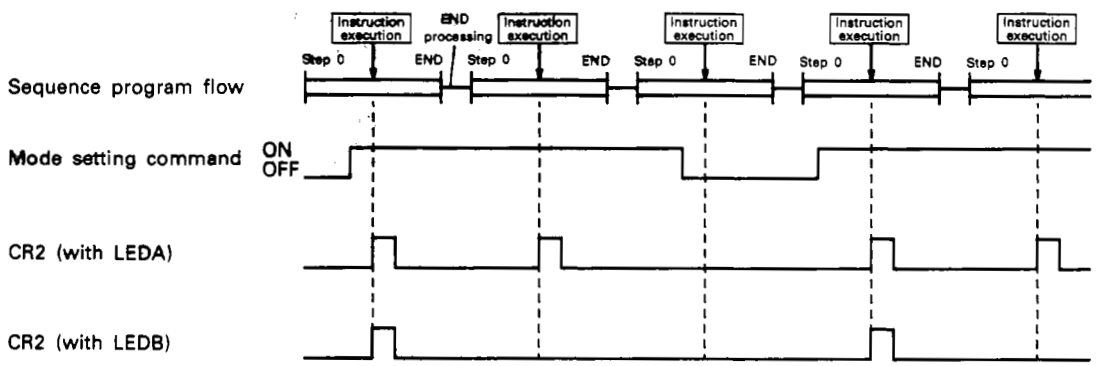


(8) After execution of the CR2 instruction, conditions of the display become as follows.

Item	Condition
Display mode	(no change)
Cursor line position	Plus one line if the designated range exceeds the last column.
Cursor column position	Current cursor position plus twice the designated number of characters
Head VRAM address displayed	(no change)
Normal/reverse designation	
Color designation	
Cursor display	

EXECUTION CONDITION

The CR2 instruction is executed every scan while the display command is ON when the LEDA instruction is used. It is executed only once at the leading edge of the display command signal when the LEDB instruction is used.



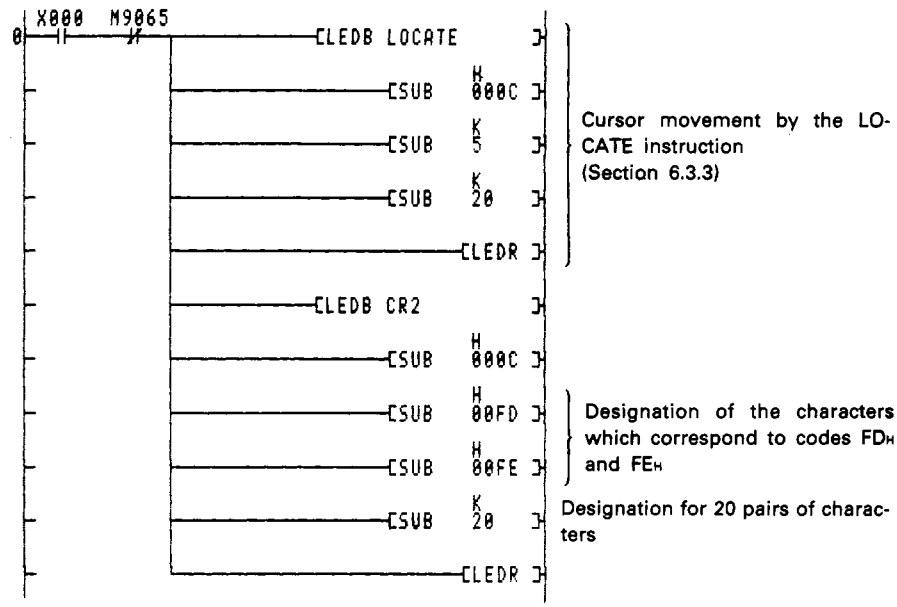
OPERATION ERROR

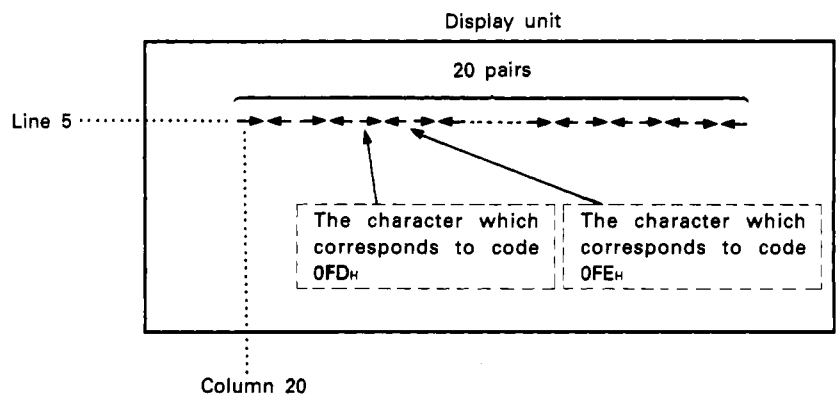
In the following cases, an operation error occurs and an error flag (M9011) is set.

Description	Error Code	
	D9008	D9091
The character codes designated by (S1) and (S2) are out of the range of 0 to 3FF.	50	503
The number of characters designated by (S2) is out of the range of 1 to 40.		

PROGRAM EXAMPLE

The following is an example of the program used to display horizontally 20 pairs of characters which correspond to character codes 0FD$_H$ and 0FE$_H$ on a display unit connected to the AD57 loaded at X/Y0C0 to 0FF.
A pair of designated characters is displayed repeatedly beginning with column 20 on line 5 by turning on X000.

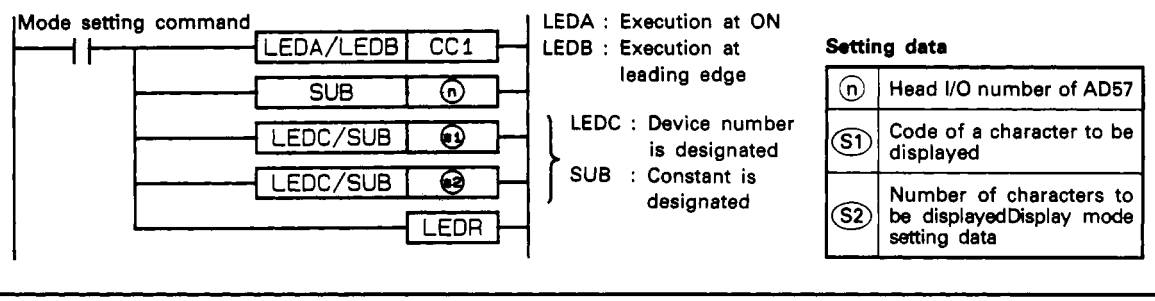




6.5.11 Vertical repeated display of a designated character·····CC1

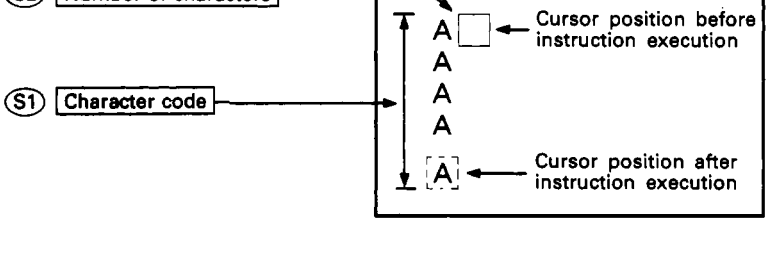
	Usable devices																				Digit specification	Number of steps	Subset	Index	Carry flag	Error flag
	Bit device							Word (16-bit) device									Constant		Pointer		Level						
	X	Y	M	L	S	B	F	T	C	D	W	R	A0	A1	Z	V	K	H	P	I	N					M9012	M9011
ⓝ																	○	○									
(S1)								○	○	○	○	○					○	○					23		○		○
(S2)								○	○	○	○	○					○	○									

*1: The number of steps varies with type of device used. See Section 5.2.



FUNCTION

(1) The CC1 instruction is used to display repeatedly a designated character which correspond to the character code designated by (S1) for the number of characters designated by (S2) in a vertical direction beginning with current cursor position on the display unit of the AD57(S1)/AD58 designated by ⓝ.



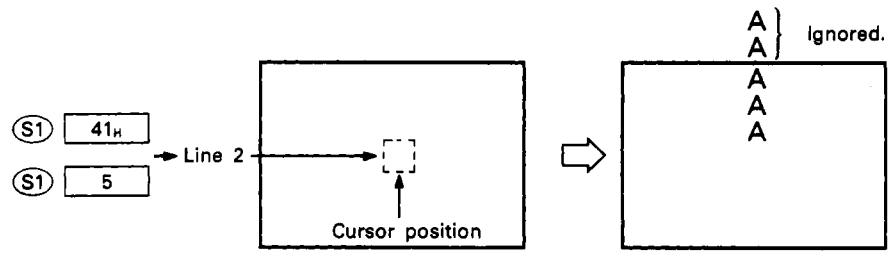
(2) The CC1 instruction is used to display vertical lines of a table and bar graphs.

(3) The head I/O number of the AD57(S1)/AD58 designated by ⓝ should be upper 2 digits of 3 hexadecimal digits.
Example) If the AD57(S1)/AD58 is assigned to X.Y120 to 13F, set "12_H" at ⓝ.

(4) The character code designated by (S1) can be set within the range of 00_H to $3FF_H$.
If code 400_H or higher is designated, an error occurs.

(5) The number of characters designated by (S2) can be set within the range of 1 to 20.

(6) If the range of the number of characters designated by (S2) beginning with the cursor position exceeds line 0, only the characters from the cursor position to line 0 are displayed. The excess characters are ignored.

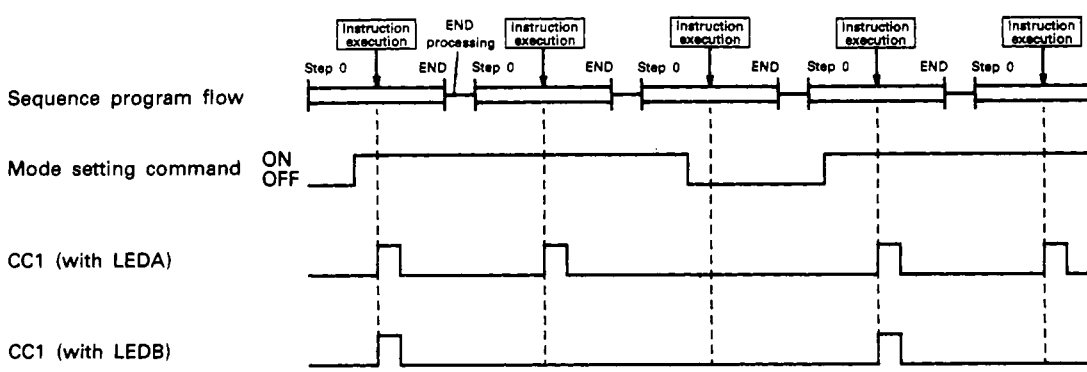


(7) After execution of the CC1 instruction, conditions of the display become as follows.

Item	Condition
Display mode	(no change)
Cursor line position	Current line minus the number of designated characters
Cursor column position	Current column position plus one
Head VRAM address displayed	(no change)
Normal/reverse designation	
Color designation	
Cursor display	

EXECUTION CONDITION

The CC1 instruction is executed every scan while the display command is ON when the LEDA instruction is used. It is executed only once at the leading edge of the display command signal when the LEDB instruction is used.



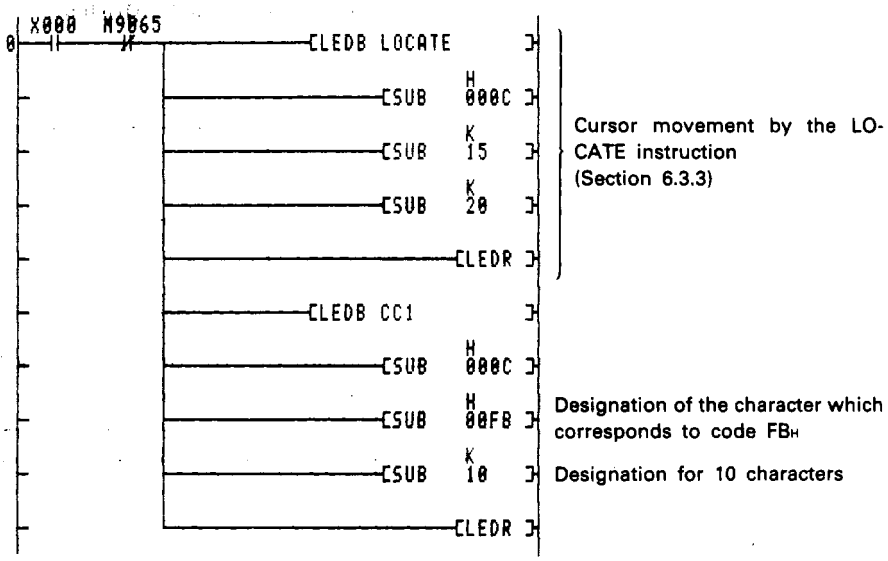
OPERATION ERROR

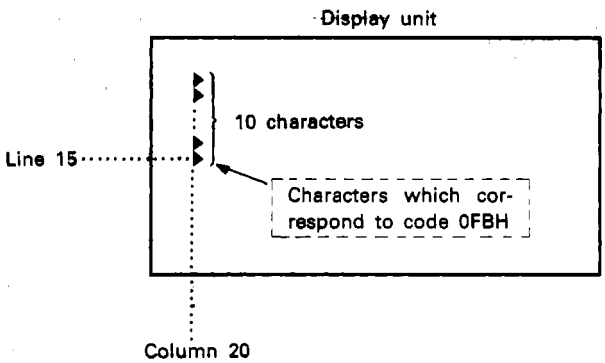
In the following cases, an operation error occurs and an error flag (M9011) is set.

Description	Error Code	
	D9008	D9091
The character code designated by (S1) is out of the range of 0 to 3FF.	50	503
The number of characters designated by (S2) is out of the range of 1 to 20.		

PROGRAM EXAMPLE

The following is an example of the program used to display vertically 10 characters which corresponds to character code 0FB$_H$ on a display unit connected to the AD57 loaded at X/Y0C0 to 0FF. A designated character is displayed repeatedly beginning with column 20 on line 15 by turning on X000.





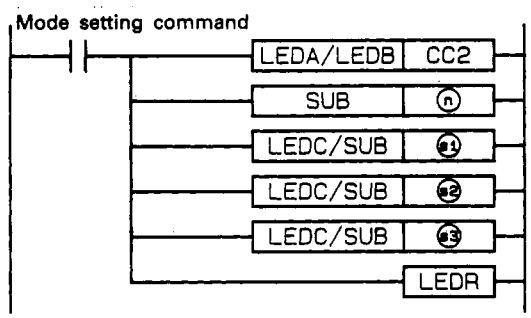
MEMO

6.5.12 Vertical repeated display of a pair of designated characters·····CC2

	Usable devices																			Digit specification	Number of steps	Subset	Index	Carry flag	Error flag
	Bit device							Word (16-bit) device									Constant		Pointer		Level					
	X	Y	M	L	S	B	F	T	C	D	W	R	A0	A1	Z	V	K	H	P	I	N					
ⓝ																	○	○								
(S1)								○	○	○	○	○					○	○								
(S2)								○	○	○	○	○					○	○					26		○	
(S3)								○	○	○	○	○					○	○								

	CC2	Carry flag	Error flag
		M9012	M9011

*1: The number of steps varies with type of device used. See Section 5.2.



LEDA : Execution at ON
LEDB : Execution at leading edge

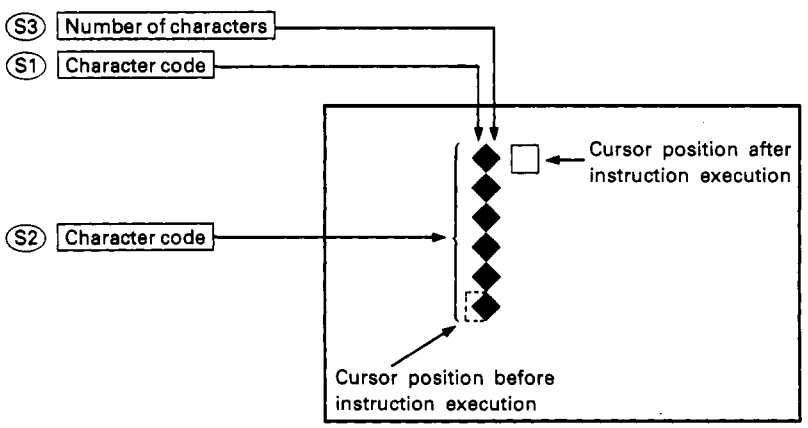
LEDC : Device number is designated
SUB : Constant is designated

Setting data

ⓝ	Head I/O number of AD57
(S1)	Codes of a pair of characters to be displayed
(S2)	
(S3)	Display mode setting data

FUNCTION

(1) The CC2 instruction is used to display repeatedly a pair of designated characters each of which corresponds to respective character code designated by (S1) and (S2) on a display unit connected to the AD57(S1)/AD58 which is designated by ⓝ. Characters are paired side by side and displayed vertically beginning with the cursor position for the number of pairs of characters designated by (S3).


(S3) Number of characters
(S1) Character code
(S2) Character code
Cursor position after instruction execution
Cursor position before instruction execution

(2) The CC2 instruction is used to display vertically pairs of characters. Each pair makes one complete figure.

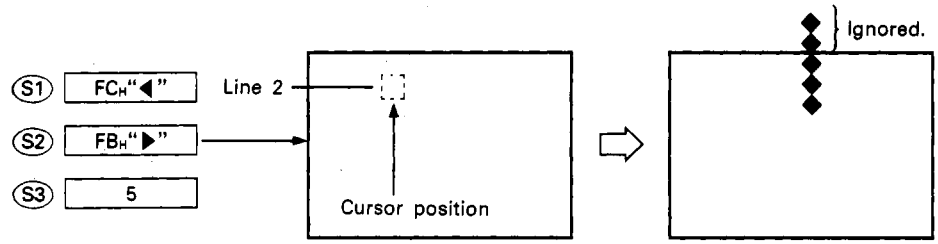
(3) The head I/O number of the AD57(S1)/AD58 designated by ⓝ should be upper 2 digits of 3 hexadecimal digits.
Example) If the AD57(S1)/AD58 is assigned to X.Y120 to 13F, set "12H" at ⓝ.

(4) The character codes designated by (S1) and (S2) can be set within the range of 00_H to $3FF_H$.
If code 400_H or higher is designated, an error occurs.

(5) The character code designated by (S1) corresponds to the left half of each pair, and the character code designated by (S2) corresponds to the right half of each pair.

(6) The number of characters designated by (S3) can be set within the range of 1 to 20.

(7) If the range of the number of characters designated by (S2) beginning with the cursor position exceeds line 0, only the characters from the cursor position to line 0 are displayed. The excess characters are ignored.

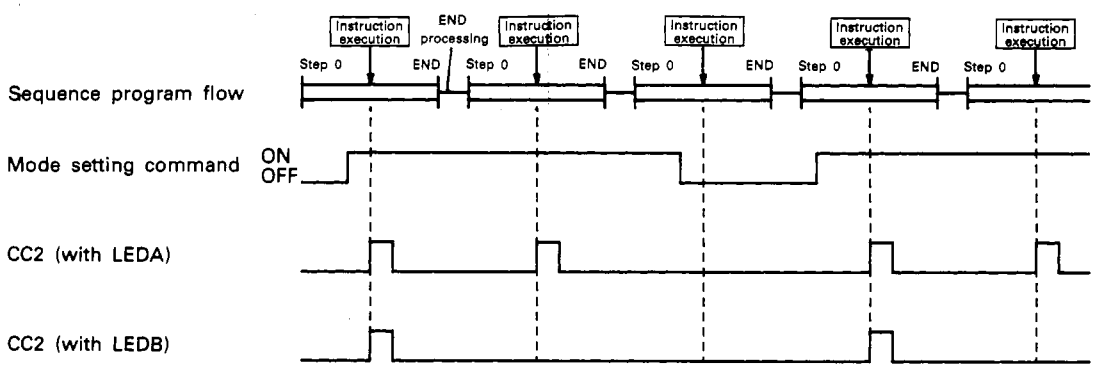


(8) After execution of the CC2 instruction, conditions of the display become as follows.

Item	Condition
Display mode	(no change)
Cursor line position	Current line minus the designated number of characters
Cursor column position	Current column plus two columns
Head VRAM address displayed	(no change)
Normal/reverse designation	
Color designation	
Cursor display	

EXECUTION CONDITION

The CC2 instruction is executed every scan while the display command is ON when the LEDA instruction is used. It is executed only once at the leading edge of the display command signal when the LEDB instruction is used.



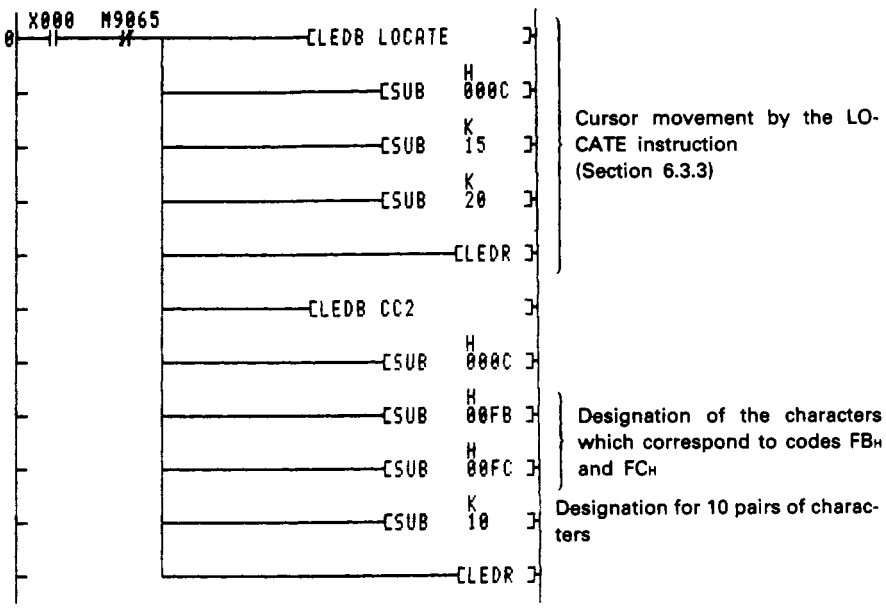
OPERATION ERROR

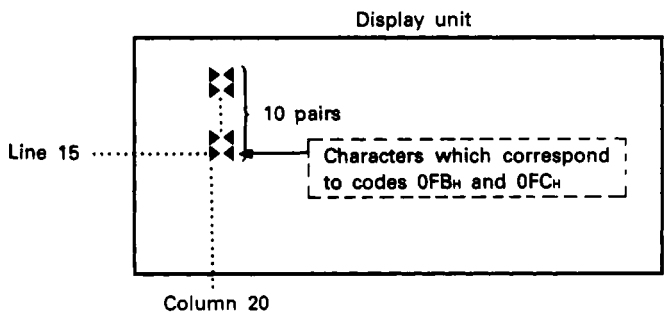
In the following cases, an operation error occurs and an error flag (M9011) is set.

Description	Error Code	
	D9008	D9091
The character codes designated by (S1) and (S2) are out of the range of 0 to 3FF.	50	503
The number of characters designated by (S2) is out of the range of 1 to 20.		

PROGRAM EXAMPLE

The following is an example of the program used to display vertically 10 pairs of characters which correspond to character codes 0FBH and 0FCH on a display unit connected to the AD57 loaded at X/Y0C0 to 0FF.
A pair of designated characters is displayed repeatedly beginning with column 20 on line 15 by turning on X000.





6.6 Fixed Character Display Instructions

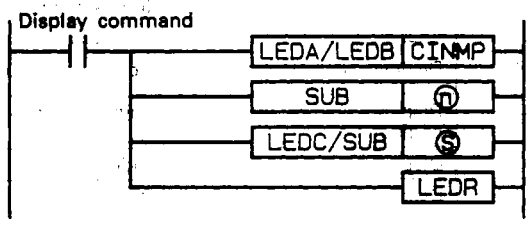
The fixed character display instructions are used to display characters each of which corresponds to respective display instruction at the cursor position.
Entry of setting data can be easily done with the fixed character display instructions.
The fixed character display instructions are classified as follows.

Category	Instruction Name	Description
"—" (minus symbol) display	CINMP	Displays a minus symbol (—) one column to the left of the designated number of columns beginning with the cursor position.
"-" (hyphen) display	CINHP	Displays a hyphen (-) at the cursor position.
"." (period or decimal point) display	CINPT	Displays a period or a decimal point (.) at the cursor position.
"0" display	CIN0	Displays "0" at the cursor position.
"1" display	CIN1	Displays "1" at the cursor position.
"2" display	CIN2	Displays "2" at the cursor position.
"3" display	CIN3	Displays "3" at the cursor position.
"4" display	CIN4	Displays "4" at the cursor position.
"5" display	CIN5	Displays "5" at the cursor position.
"6" display	CIN6	Displays "6" at the cursor position.
"7" display	CIN7	Displays "7" at the cursor position.
"8" display	CIN8	Displays "8" at the cursor position.
"9" display	CIN9	Displays "9" at the cursor position.
"A" display	CINA	Displays "A" at the cursor position.
"B" display	CINB	Displays "B" at the cursor position.
"C" display	CINC	Displays "C" at the cursor position.
"D" display	CIND	Displays "D" at the cursor position.
"E" display	CINE	Displays "E" at the cursor position.
"F" display	CINF	Displays "F" at the cursor position.
"G" display	CING	Displays "G" at the cursor position.
"H" display	CINH	Displays "H" at the cursor position.
"I" display	CINI	Displays "I" at the cursor position.
"J" display	CINJ	Displays "J" at the cursor position.
"K" display	CINK	Displays "K" at the cursor position.
"L" display	CINL	Displays "L" at the cursor position.
"M" display	CINM	Displays "M" at the cursor position.
"N" display	CINN	Displays "N" at the cursor position.
"O" display	CINO	Displays "O" at the cursor position.
"P" display	CINP	Displays "P" at the cursor position.
"Q" display	CINQ	Displays "Q" at the cursor position.
"R" display	CINR	Displays "R" at the cursor position.
"S" display	CINS	Displays "S" at the cursor position.
"T" display	CINT	Displays "T" at the cursor position.
"U" display	CINU	Displays "U" at the cursor position.
"V" display	CINV	Displays "V" at the cursor position.
"W" display	CINW	Displays "W" at the cursor position.
"X" display	CINX	Displays "X" at the cursor position.
"Y" display	CINY	Displays "Y" at the cursor position.
"Z" display	CINZ	Displays "Z" at the cursor position.
" " (space) display	CINSP	Displays a space symbol (" ") at the cursor position.

6.6.1 Display of a minus symbol ("—")·····CINMP

	Usable devices																				Digit specification	Number of steps	Subset	Index	Carry flag	Error flag
	Bit device							Word (16-bit) device									Constant		Pointer		Level						
	X	Y	M	L	S	B	F	T	C	D	W	R	A0	A1	Z	V	K	H	P	I	N					M9012	M9011
ⓝ																	○	○					20		○		○
Ⓢ								○	○	○	○	○					○	○									

*1: The number of steps varies with type of device used. See Section 5.2.



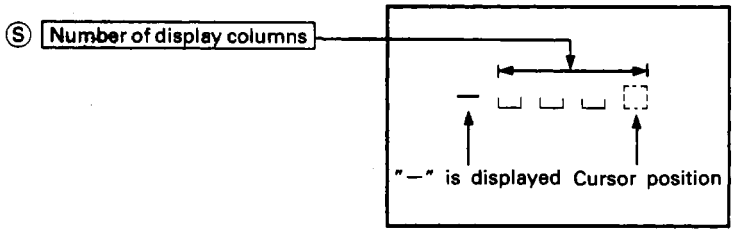
LEDA : Execution at ON
LEDB : Execution at leading edge
LEDC : Device number is designated
SUB : Constant is designated

Setting data

ⓝ	Head I/O number of AD57
Ⓢ	Number of display columns

FUNCTION

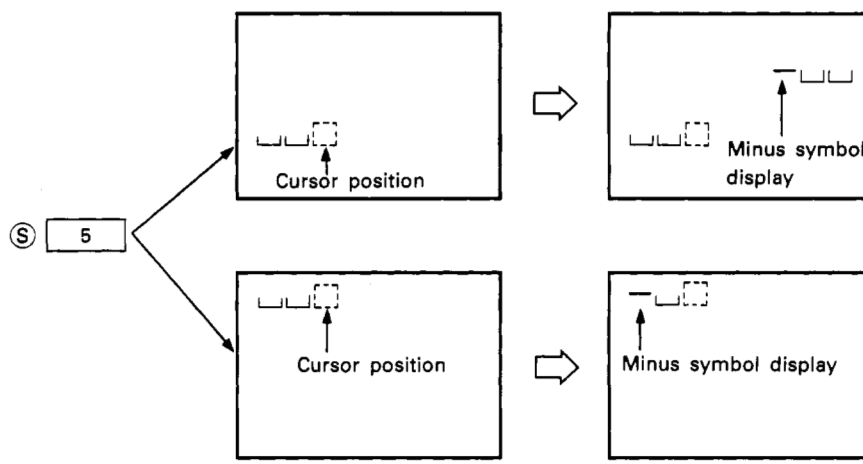
(1) The CINMP instruction is used to display a minus (—) symbol one column to the left of the columns designated by Ⓢ beginning with the cursor position on the display unit of the AD57(S1)/AD58 designated by ⓝ. The characters between the minus symbol and the cursor are cleared.



(2) The head I/O number of the AD57(S1)/AD58 designated by ⓝ should be upper 2 digits of 3 hexadecimal digits.
Example) If the AD57(S1)/AD58 is assigned to X/Y120 to 13F, set "12H" at ⓝ.

(3) The number of display columns designated by Ⓢ can be set within the range of 1 to 16.
Characters can be displayed at the designated display columns using the CIN⬚ instructions.

(4) If the range of the number of columns designated by Ⓢ plus one column beginning with the cursor position exceeds column 0 on a line, the excess range laps around to the last column of the previous line, and a minus symbol is displayed one column to the left of the excess columns.
If the designated range exceeds column 0 of line 0 on the screen, a minus symbol is displayed at column 0 on line 0.

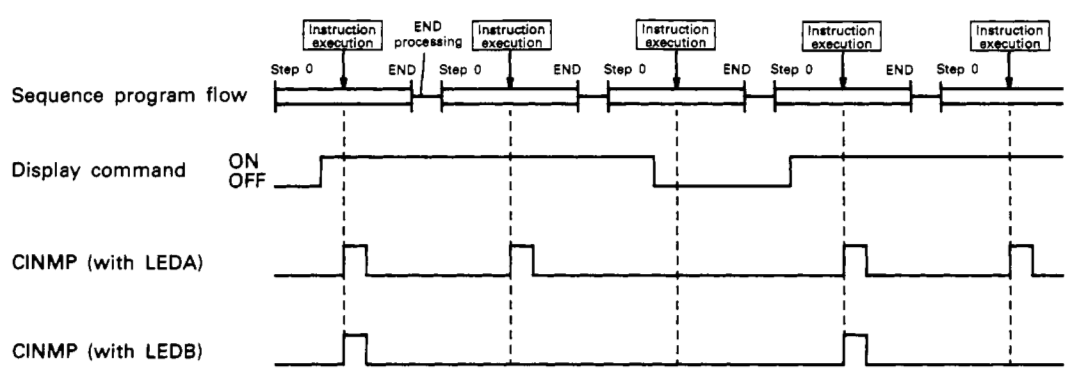


(5) After execution of the CINMP instruction, conditions of the display become as follows.

Item	Condition
Display mode	(no change)
Cursor line position	
Cursor column position	
Head VRAM address displayed	
Normal/reverse designation	
Color designation	
Cursor display	

EXECUTION CONDITION

The CINMP instruction is executed every scan while the display command is ON when the LEDA instruction is used. It is executed only once at the leading edge of the display command signal when the LEDB instruction is used.



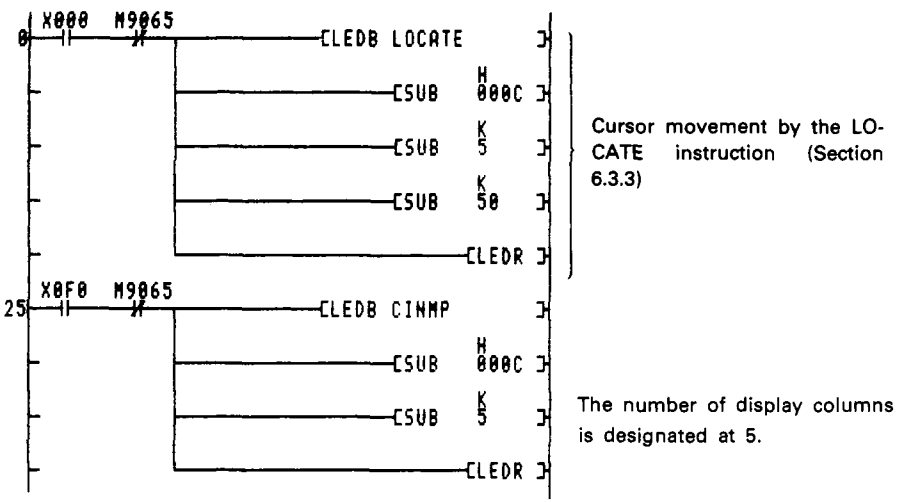
OPERATION ERROR

In the following case, an operation error occurs and an error flag (M9011) is set.

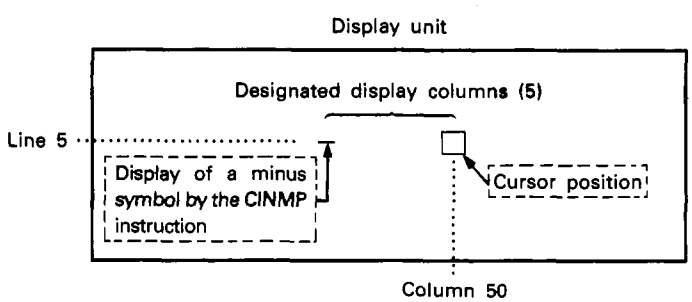
Description	Error Code	
	D9008	D9091
The number of display columns designated by Ⓢ is out of the range of 1 to 16.	50	503

PROGRAM EXAMPLE

The following is an example of the program used to display a minus symbol (—) on a display unit connected to the AD57 loaded at X/Y0C0 to 0FF.
A minus symbol is displayed by turning on X0F0.
The position of display is designated at columns 45 to 50 on line 5.



The CINMP instruction is used for data entry together with other instructions such as CINHP, CINPT, CIN (alphanumerics), CINSP, CINCLR and INPUT. (Refer to Section 7.3 for details.)
By execution of the CINMP instruction, a minus symbol (—) is displayed one column to the left of the designated columns.

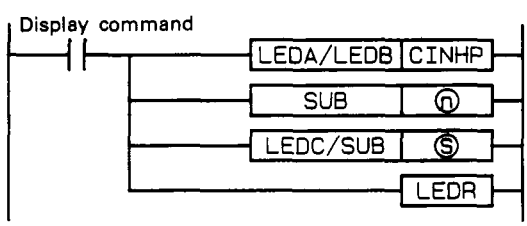


MEMO

6.6.2 Display of a hyphen ("-")·····CINHP

	Usable devices																				Digit specification	Number of steps	Subset	Index	Carry flag	Error flag
	Bit device							Word (16-bit) device									Constant		Pointer		Level					
	X	Y	M	L	S	B	F	T	C	D	W	R	A0	A1	Z	V	K	H	P	I	N				M9012	M9011
ⓝ																	○	○					20			○
Ⓢ								○	○	○	○	○					○	○						○		

*1: The number of steps varies with type of device used. See Section 5.2.



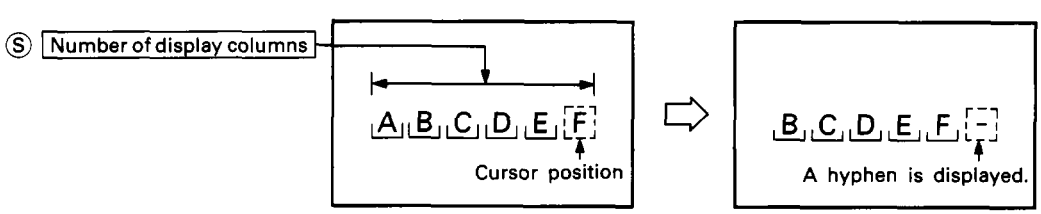
LEDA : Execution at ON
LEDB : Execution at leading edge
LEDC : Device number is designated
SUB : Constant is designated

Setting data

ⓝ	Head I/O number of AD57
Ⓢ	Number of display columns

FUNCTION

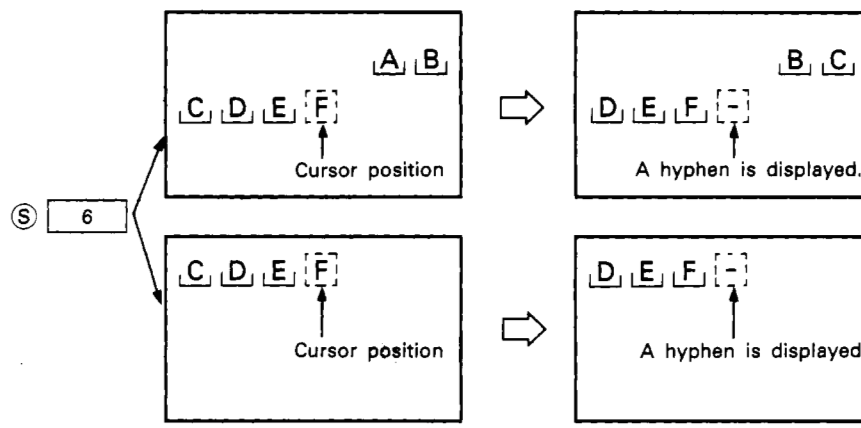
(1) The CINHP instruction is used to display a hyphen (-) at the cursor position and shift the characters in the range designated by Ⓢ beginning with the cursor position one column to the left on the display unit of the AD57(S1)/AD58 designated by ⓝ.



(2) The head I/O number of the AD57(S1)/AD58 designated by ⓝ should be upper 2 digits of 3 hexadecimal digits.
Example) If the AD57(S1)/AD58 is assigned to X/Y120 to 13F, set "12H" at ⓝ.

(3) The number of display columns designated by Ⓢ can be set within the range of 1 to 16.
Characters can be displayed at the designated display columns using the CIN[ ] instructions.
When a character is displayed by use of the CIN[ ] instruction within the designated display columns, characters are shifted one column to the left.

(4) If the range of display columns designated by Ⓢ beginning with the cursor position exceeds column 0 on a line, the excess range laps around to the last column of the previous line. And, characters in the excess range are shifted one column to the left.
If the designated range exceeds column 0 of line 0 on the screen, only the characters up to column 0 on line 0 are shifted.
Characters which exceed column 0 on line 0 are erased.

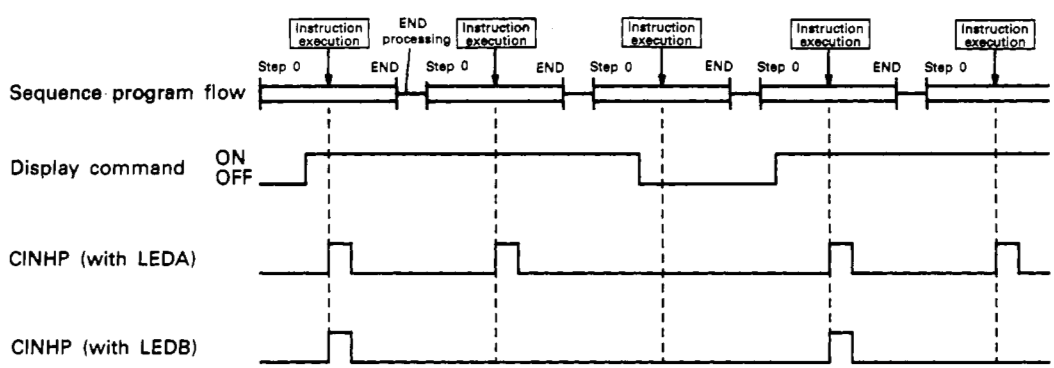


(5) After execution of the CINHP instruction, conditions of the display become as follows.

Item	Condition
Display mode	(no change)
Cursor line position	
Cursor column position	
Head VRAM address displayed	
Normal/reverse designation	
Color designation	
Cursor display	

EXECUTION CONDITION

The CINHP instruction is executed every scan while the display command is ON when the LEDA instruction is used. It is executed only once at the leading edge of the display command signal when the LEDB instruction is used.



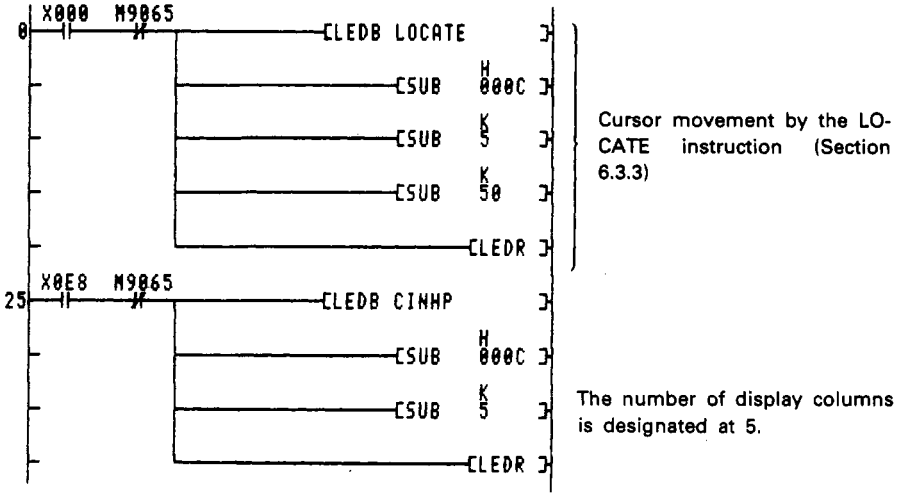
OPERATION ERROR

In the following case, an operation error occurs and an error flag (M9011) is set.

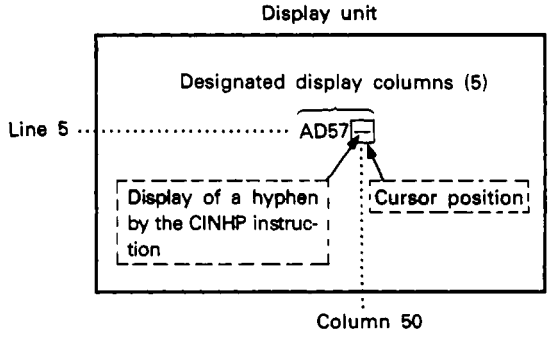
Description	Error Code	
	D9008	D9091
The number of display columns designated by Ⓢ is out of the range of 1 to 16.	50	503

PROGRAM EXAMPLE

The following is an example of the program used to display a hyphen (-) on a display unit connected to the AD57 loaded at X/Y0C0 to 0FF.
A hyphen is displayed by turning on X0E8.
The position of display is designated at columns 45 to 50 on line 5.



The CINHP instruction is used for data entry together with other instructions such as CINMP, CINPT, CIN (alphanumerics), CINSP, CINCLR and INPUT. (Refer to Section 7.3 for details.)
By execution of the CINHP instruction, a hyphen (-) is displayed at the cursor position, and the characters within the designated range are shifted one column to the left.

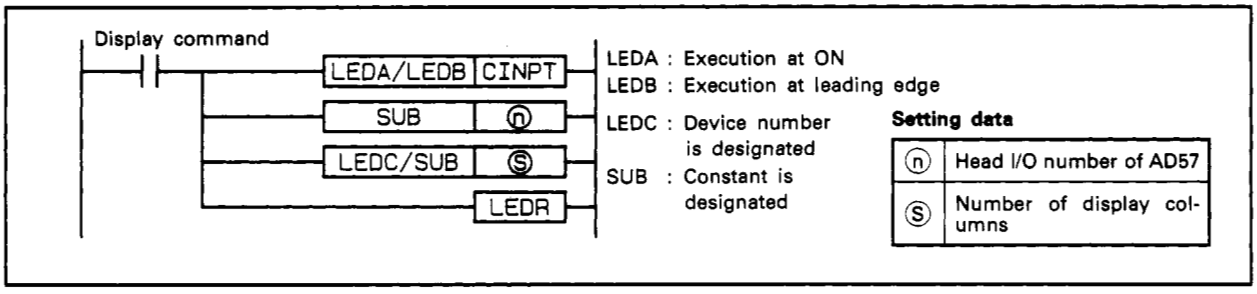


MEMO

6.6.3 Display of a period or a decimal point (".")·····CINPT

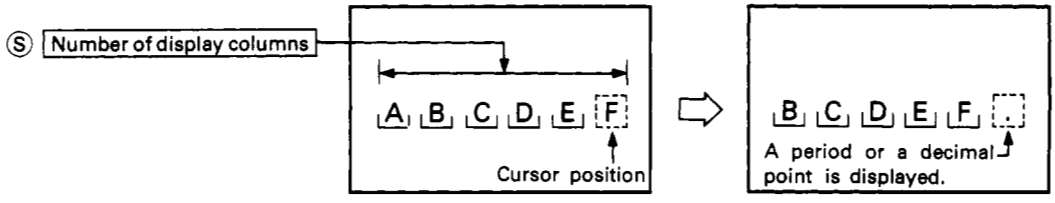
	Usable devices																			Digit specification	Number of steps	Subset	Index	Carry flag	Error flag
	Bit device							Word (16-bit) device								Constant		Pointer		Level					
	X	Y	M	L	S	B	F	T	C	D	W	R	A0	A1	Z	V	K	H	P	I	N					M9012	M9011
ⓝ																	○	○					20		○		○
Ⓢ								○	○	○	○	○					○	○									

*1: The number of steps varies with type of device used. See Section 5.2.



FUNCTION

(1) The CINPT instruction is used to display a period or a decimal point (.) at the cursor position and shift the characters in the range designated by Ⓢ beginning with the cursor position one column to the left on the display unit of the AD57(S1)/AD58 designated by ⓝ.

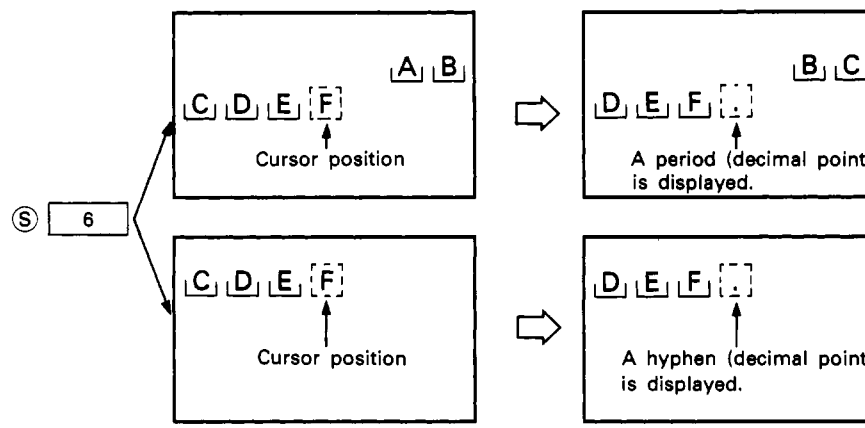


(2) The head I/O number of the AD57(S1)/AD58 designated by ⓝ should be upper 2 digits of 3 hexadecimal digits.

Example) If the AD57(S1)/AD58 is assigned to X/Y120 to 13F, set "12_H" at ⓝ.

(3) The number of display columns designated by Ⓢ can be set within the range of 1 to 16.
Characters can be displayed at the designated display columns using the CIN[ ] instructions.
When a character is displayed by use of the CIN[ ] instruction within the designated display columns, characters are shifted one column to the left.

(4) If the range of display columns designated by Ⓢ beginning with the cursor position exceeds column 0 on a line, the excess range laps around to the last column of the previous line. And, characters in the excess range are shifted one column to the left.
If the designated range exceeds column 0 of line 0 on the screen, only the characters up to column 0 on line 0 are shifted.
Characters which exceed column 0 on line 0 are erased.

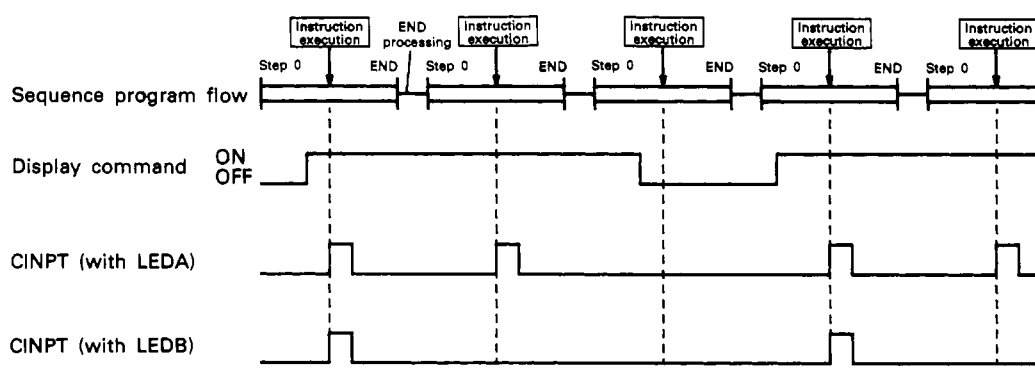


(5) After execution of the CINPT instruction, conditions of the display become as follows.

Item	Condition
Display mode	(no change)
Cursor line position	
Cursor column position	
Head VRAM address displayed	
Normal/reverse designation	
Color designation	
Cursor display	

EXECUTION CONDITION

The CINPT instruction is executed every scan while the display command is ON when the LEDA instruction is used. It is executed only once at the leading edge of the display command signal when the LEDB instruction is used.



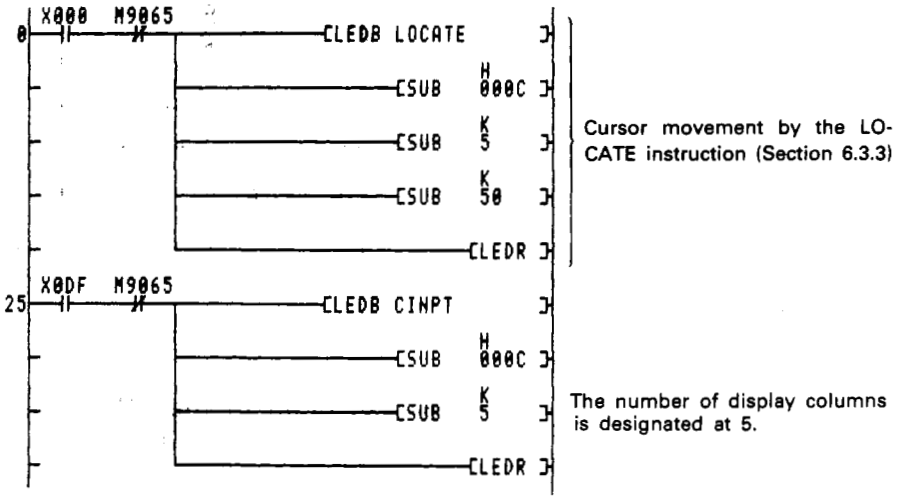
OPERATION ERROR

In the following case, an operation error occurs and an error flag (M9011) is set.

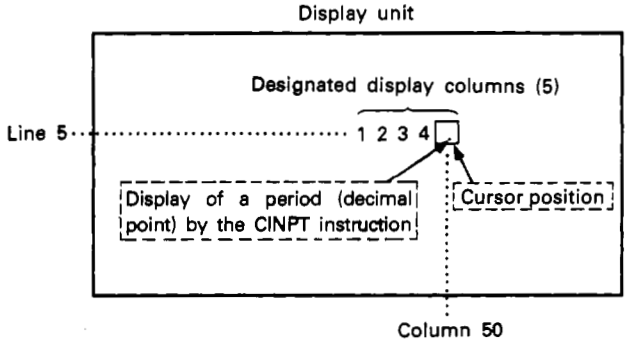
Description	Error Code	
	D9008	D9091
The number of display columns designated by Ⓢ is out of the range of 1 to 16.	50	503

PROGRAM EXAMPLE

The following is an example of the program used to display a period or a decimal point (.) on a display unit connected to the AD57 loaded at X/Y0C0 to 0FF.
A period or a decimal point is displayed by turning on X0DF.
The position of display is designated at columns 45 to 50 on line 5.



The CINPT instruction is used for data entry together with other instructions such as CINMP, CINHP, CIN (alphanumerics), CINSP, CINCLR and INPUT. (Refer to Section 7.3 for details.)
By execution of the CINPT instruction, a period or a decimal point (.) is displayed at the cursor position, and the characters within the designated range are shifted one column to the left.

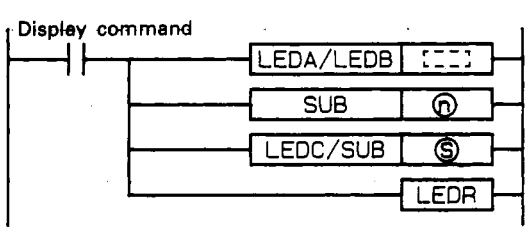


MEMO

6.6.4 Display of the alphanumeric characters "0" to "9" and "A" to "Z"·····CIN[ ] ([ ]: 0 to 9 or A to Z)

	Usable devices																				Digit specification	Number of steps	Subset	Index	Carry flag	Error flag
	Bit device							Word (16-bit) device									Constant		Pointer		Level					
	X	Y	M	L	S	B	F	T	C	D	W	R	A0	A1	Z	V	K	H	P	I	N				M9012	M9011
ⓝ																	○	○								
Ⓢ								○	○	○	○	○					○	○					20		○		○

*1: The number of steps varies with type of device used. See Section 5.2.



LEDA : Execution at ON
LEDB : Execution at leading edge
LEDC : Device number is designated
SUB : Constant is designated

Instruction number in [ ]

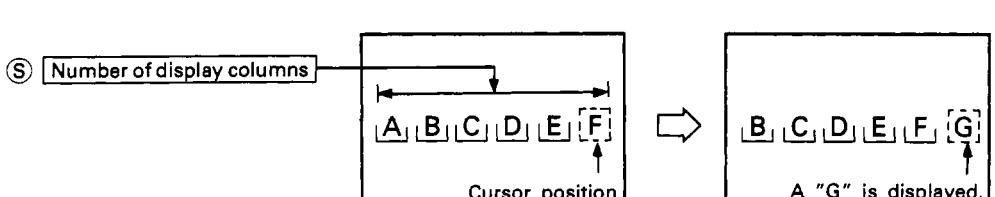
CIN0~CIN9
CINA~CINZ

Setting data

ⓝ	Head I/O number of AD57
Ⓢ	Number of display columns

FUNCTION

(1) The CIN[ ] instruction is used to display the alphanumeric characters ("0" to "9" or "A" to "Z") at the cursor position and shift the characters in the range designated by Ⓢ beginning with the cursor position one column to the left on the display unit of the AD57(S1)/AD58 designated by ⓝ.



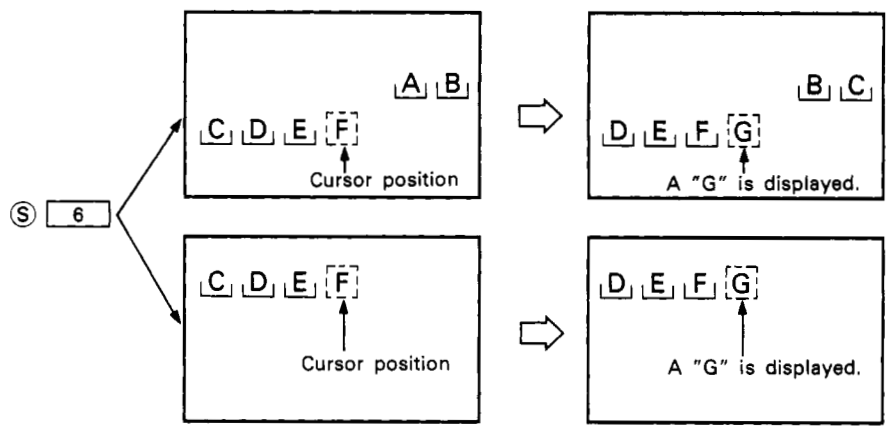
(2) Use the following instructions according to the alphanumeric characters to be displayed.

Instruction	Character	Instruction	Character	Instruction	Character	Instruction	Character
CIN0	"0"	CINA	"A"	CINK	"K"	CINU	"U"
CIN1	"1"	CINB	"B"	CINL	"L"	CINV	"V"
CIN2	"2"	CINC	"C"	CINK	"M"	CINW	"W"
CIN3	"3"	CIND	"D"	CINN	"N"	CINX	"X"
CIN4	"4"	CINE	"E"	CINO	"O"	CINY	"Y"
CIN5	"5"	CINF	"F"	CINP	"P"	CINZ	"Z"
CIN6	"6"	CING	"G"	CINQ	"Q"		
CIN7	"7"	CINH	"H"	CINR	"R"		
CIN8	"8"	CINI	"I"	CINS	"S"		
CIN9	"9"	CINJ	"J"	CINT	"T"		

(3) The head I/O number of the AD57(S1)/AD58 designated by ⓝ should be upper 2 digits of 3 hexadecimal digits.
Example) If the AD57(S1)/AD58 is assigned to X/Y120 to 13F, set "12H" at ⓝ.

(4) The number of display columns designated by Ⓢ can be set within the range of 1 to 16.
Characters can be displayed at the designated display columns using the CIN[ ] instructions.
When a character is displayed by use of the CIN[ ] instruction within the designated display columns, characters are shifted one column to the left.

(5) If the range of display columns designated by Ⓢ beginning with the cursor position exceeds column 0 on a line, the excess range laps around to the last column of the previous line. And, characters in the excess range are shifted one column to the left.
If the designated range exceeds column 0 of line 0 on the screen, only the characters up to column 0 on line 0 are shifted.
Characters which exceed column 0 on line 0 are erased.

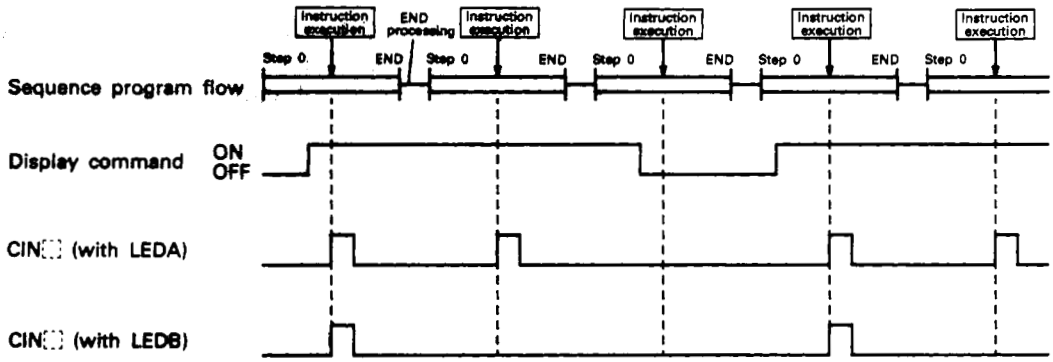


(6) After execution of the CIN[ ] instruction, conditions of the display become as follows.

Item	Condition
Display mode	(no change)
Cursor line position	
Cursor column position	
Head VRAM address displayed	
Normal/reverse designation	
Color designation	
Cursor display	

EXECUTION CONDITION

The CIN[ ] instruction is executed every scan while the display command is ON when the LEDA instruction is used. It is executed only once at the leading edge of the display command signal when the LEDB instruction is used.



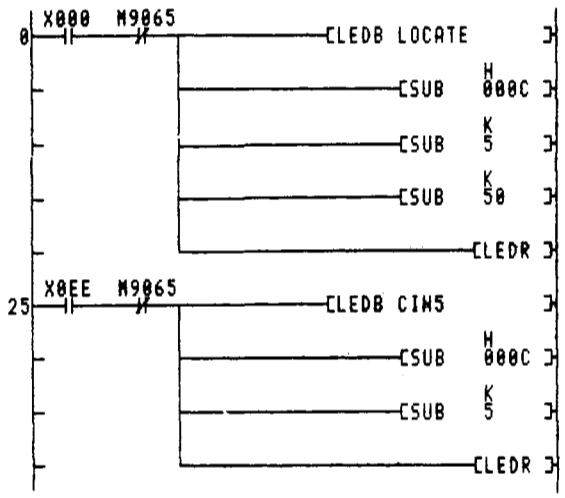
OPERATION ERROR

In the following case, an operation error occurs and an error flag (M9011) is set.

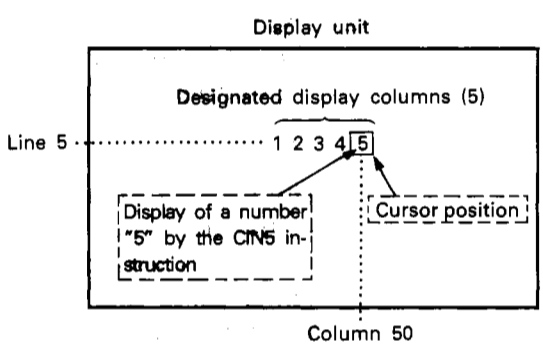
Description	Error Code	
	D9008	D9091
The number of display columns designated by Ⓢ is out of the range of 1 to 16.	50	503

PROGRAM EXAMPLE

The following is an example of the program used to display a number "5" at a designated position on a display unit connected to the AD57 loaded at X/Y0C0 to 0FF.
The alphanumeric characters are displayed by turning on X0EE.
The position of display is designated at columns 45 to 50 on line 5.



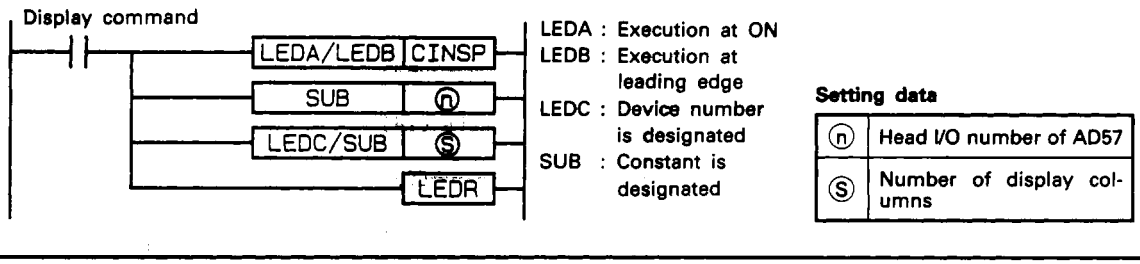
The CIN5 instruction is used for data entry together with other instructions such as CINMP, CINHP, CIN (alphanumerics), CINSP, CINCLR and INPUT. (Refer to Section 7.3 for details.)
By execution of the CIN5 instruction, a number "5" is displayed at the cursor position, and the characters within the designated range are shifted one column to the left.



6.6.5 Display of a space ("␣")·····CINSP

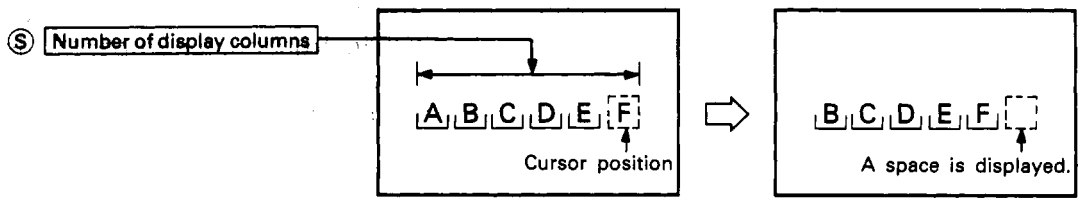
	Usable devices																				Digit specification	Number of steps	Subset	Index	Carry flag	Error flag
	Bit device							Word (16-bit) device									Constant		Pointer		Level						
	X	Y	M	L	S	B	F	T	C	D	W	R	A0	A1	Z	V	K	H	P	I	N					M9012	M9011
ⓝ																	○	○									
Ⓢ								○	○	○	○	○					○	○					20		○		○

*1: The number of steps varies with type of device used. See Section 5.2.



FUNCTION

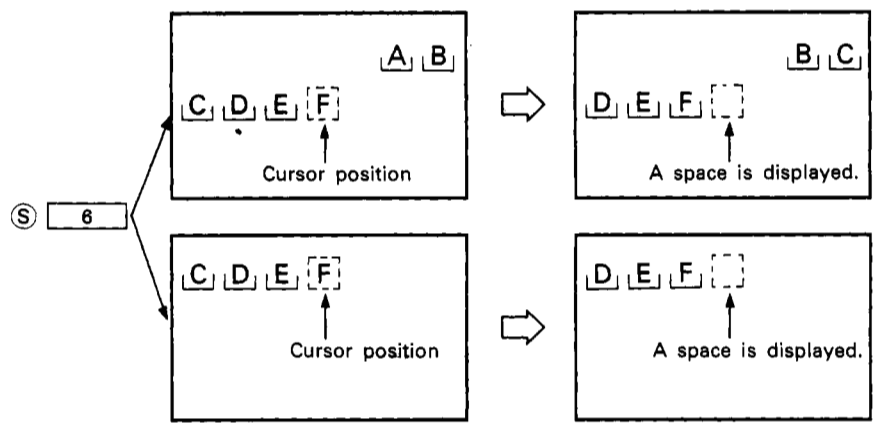
(1) The CINSP instruction is used to display a space ("␣") at the cursor position and shift the characters in the range designated by Ⓢ beginning with the cursor position one column to the left on the display unit of the AD57(S1)/AD58 designated by ⓝ.



(2) The head I/O number of the AD57(S1)/AD58 designated by ⓝ should be upper 2 digits of 3 hexadecimal digits.
Example) If the AD57(S1)/AD58 is assigned to X/Y120 to 13F, set "12H" at ⓝ.

(3) The number of display columns designated by Ⓢ can be set within the range of 1 to 16.
Characters can be displayed at the designated display columns using the CIN[ ] instructions.
When a character is displayed by use of the CIN[ ] instruction within the designated display columns, characters are shifted one column to the left.

(4) If the range of display columns designated by Ⓢ beginning with the cursor position exceeds column 0 on a line, the excess range laps around to the last column of the previous line. And, characters in the excess range are shifted one column to the left.
If the designated range exceeds column 0 of line 0 on the screen, only the characters up to column 0 on line 0 are shifted.
Characters which exceed column 0 on line 0 are erased.

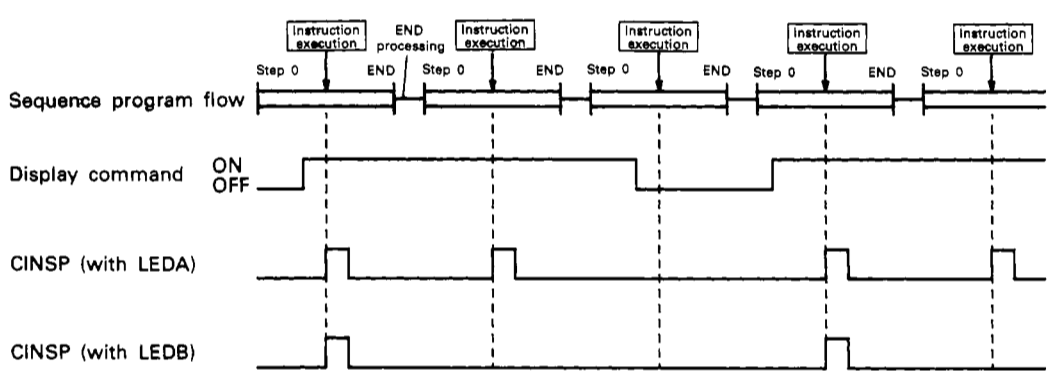


(5) After execution of the CINSP instruction, conditions of the display become as follows.

Item	Condition
Display mode	(no change)
Cursor line position	
Cursor column position	
Head VRAM address displayed	
Normal/reverse designation	
Color designation	
Cursor display	

EXECUTION CONDITION

The CINSP instruction is executed every scan while the display command is ON when the LEDA instruction is used. It is executed only once at the leading edge of the display command signal when the LEDB instruction is used.



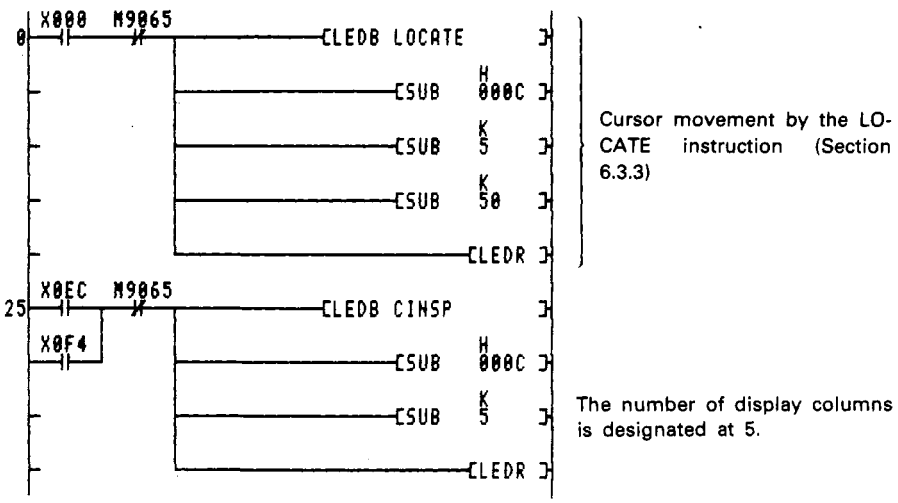
OPERATION ERROR

In the following case, an operation error occurs and an error flag (M9011) is set.

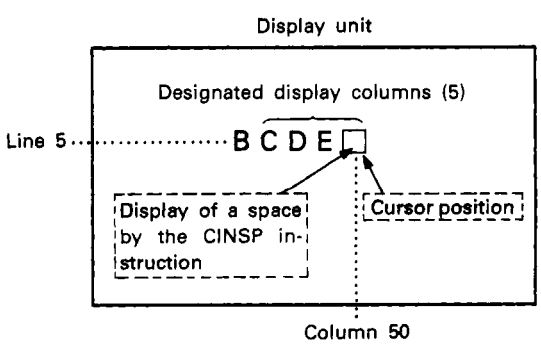
Description	Error Code	
	D9008	D9091
The number of display columns designated by Ⓢ is out of the range of 1 to 16.	50	503

PROGRAM EXAMPLE

The following is an example of the program used to display a space at a designated position on a display unit connected to the AD57 loaded at X/Y0C0 to 0FF.
A space ("␣") is displayed by turning on X0EC or X0F4.
The position of display is designated at columns 45 to 50 on line 5.



The CINSP instruction is used for data entry together with other instructions such as CINMP, CINHP, CINPT, CIN (alphanumerics), CINCLR and INPUT. (Refer to Section 7.3 for details.)
By execution of the CINSP instruction, a space is displayed at the cursor position, and the characters within the designated range are shifted one column to the left.



6.7 Designated Column Clear Instruction

The designated column clear instruction is used to clear characters at designated positions on the screen.

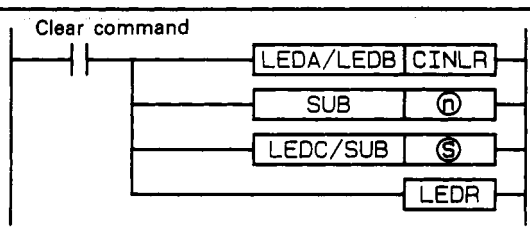
Execute designated column clear by use of the following instruction.

Category	Instruction Name	Description
Designated column clear	CINCLR	Clears characters at designated columns to the left of the cursor position.

6.7.1 Designated column clear·····CINCLR

	Usable devices																				Digit specification	Number of steps	Subset	Index	Carry flag	Error flag
	Bit device							Word (16-bit) device									Constant		Pointer		Level						
	X	Y	M	L	S	B	F	T	C	D	W	R	A0	A1	Z	V	K	H	P	I	N					M9012	M9011
ⓝ																	○	○					20		○		○
Ⓢ								○	○	○	○	○					○	○									

*1: The number of steps varies with type of device used. See Section 5.2.



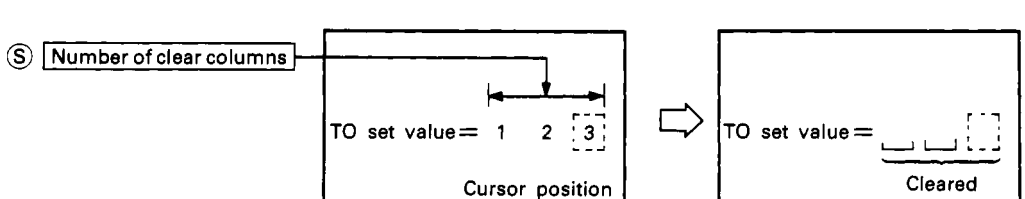
LEDA : Execution at ON
LEDB : Execution at leading edge
LEDC : Device number is designated
SUB : Constant is designated

Setting data

ⓝ	Head I/O number of AD57
Ⓢ	Number of clear columns

FUNCTION

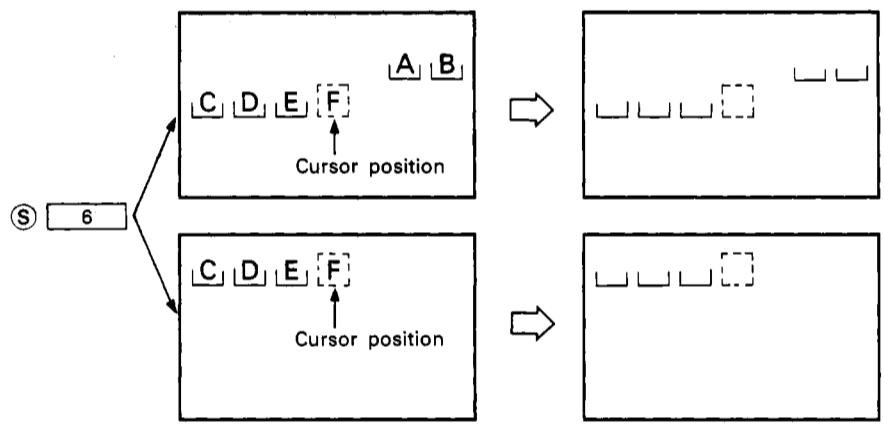
(1) The CINCLR instruction is used to clear characters of the number of columns designated by Ⓢ to the left of, and beginning with, the cursor position on a display unit connected to the AD57(S1)/AD58 designated by ⓝ.



(2) The head I/O number of the AD57(S1)/AD58 designated by ⓝ should be upper 2 digits of 3 hexadecimal digits.
Example) If the AD57(S1)/AD58 is assigned to X/Y120 to 13F, set "12_H" at ⓝ.

(3) The number of clear columns designated by Ⓢ can be set within the range of 1 to 80.

(4) If the range of clear columns designated by Ⓢ beginning with the cursor position exceeds column 0 on a line, the excess range laps around to the last column of the previous line. And, characters in the excess range are cleared to the left.
If the designated range exceeds column 0 of line 0 on the screen, only the characters up to column 0 on line 0 are cleared.
Characters which exceed column 0 on line 0 are ignored.

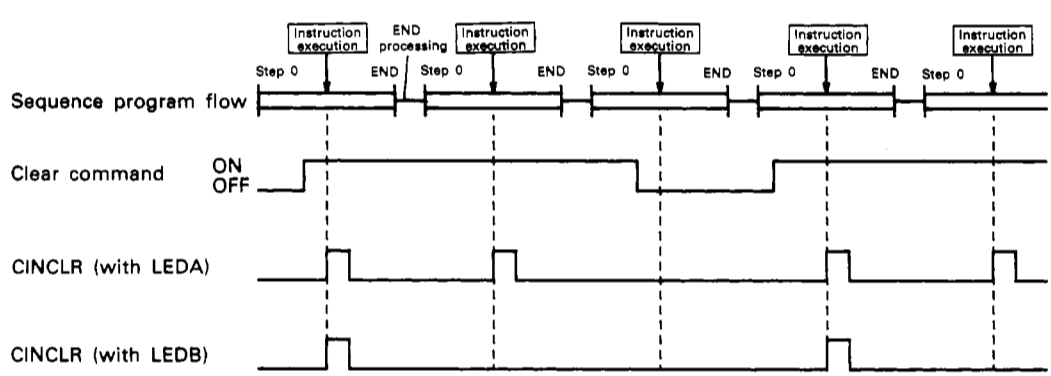


(5) After execution of the CINCLR instruction, conditions of the display become as follows.

Item	Condition
Display mode	(no change)
Cursor line position	
Cursor column position	
Head VRAM address displayed	
Normal/reverse designation	
Color designation	
Cursor display	

EXECUTION CONDITION

The CINCLR instruction is executed every scan while the clear command is ON when the LEDA instruction is used. It is executed only once at the leading edge of the clear command signal when the LEDB instruction is used.



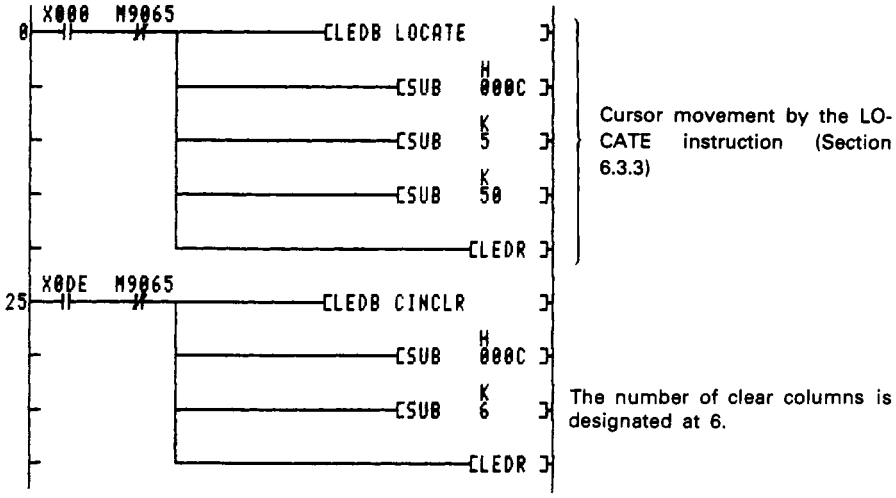
OPERATION ERROR

In the following case, an operation error occurs and an error flag (M9011) is set.

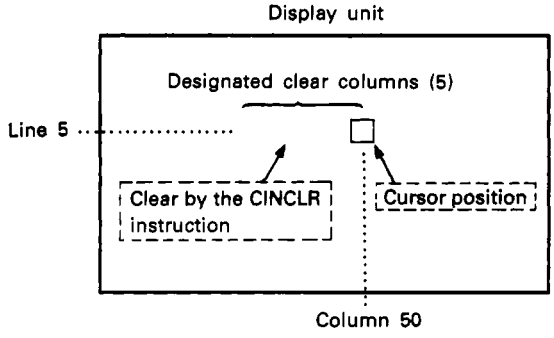
Description	Error Code	
	D9008	D9091
The number of clear columns designated by Ⓢ is out of the range of 1 to 80.	50	503

PROGRAM EXAMPLE

The following is an example of the program used to clear designated number of columns on a display unit connected to the AD57 loaded at X/Y0C0 to 0FF.
Clear is executed by turning on X0DE.
The position of display is designated at columns 45 to 50 on line 5.



The CINCLR instruction is used for data entry together with other instructions such as CINMP, CINHP, CINPT, CIN (alphanumerics), CINSP and INPUT. (Refer to Section 7.3 for details.)
By execution of the CINCLR instruction, characters within the designated range to the left of the cursor position are cleared.



6.8 ASCII Code Conversion Instruction

The ASCII code conversion instruction is used to convert the ASCII characters being displayed on the screen to the ASCII codes and store them in designated devices.
By use of the ASCII code conversion instruction, the store processing of designated data in the PC CPU can be easily performed.

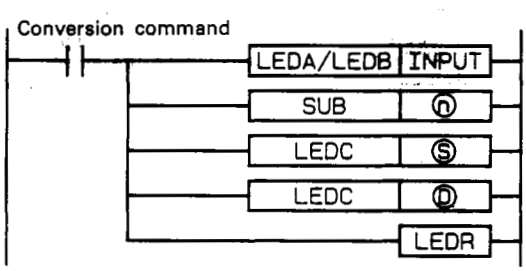
Execute the ASCII code conversion of displayed characters by use of the following instruction.

Category	Instruction Name	Description
ASCII code conversion of displayed characters	INPUT	Inputs the ASCII codes which correspond to the ASCII characters displayed on the screen.

6.8.1 ASCII code conversion of displayed characters·····INPUT

	Usable devices																				Digit specification	Number of steps	Subset	Index	Carry flag	Error flag
	Bit device							Word (16-bit) device									Constant		Pointer		Level					
	X	Y	M	L	S	B	F	T	C	D	W	R	A0	A1	Z	V	K	H	P	I	N					M9012	M9011
ⓝ																	○	○									
Ⓢ								○	○	○	○	○											23		○		○
Ⓓ								○	○	○	○	○															

*1: The number of steps varies with type of device used. See Section 5.2.



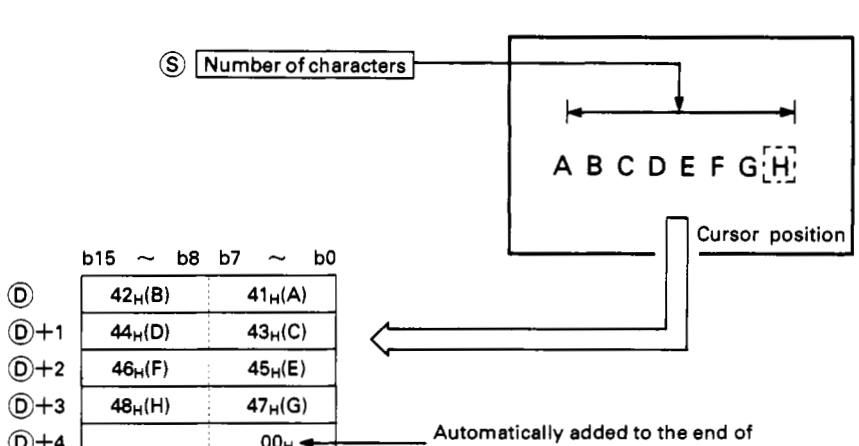
LEDA : Execution at ON
LEDB : Execution at leading edge

Setting data

ⓝ	Head I/O number of AD57
Ⓢ	Number of characters to be converted
Ⓓ	Head number of the devices which store converted ASCII codes

FUNCTION

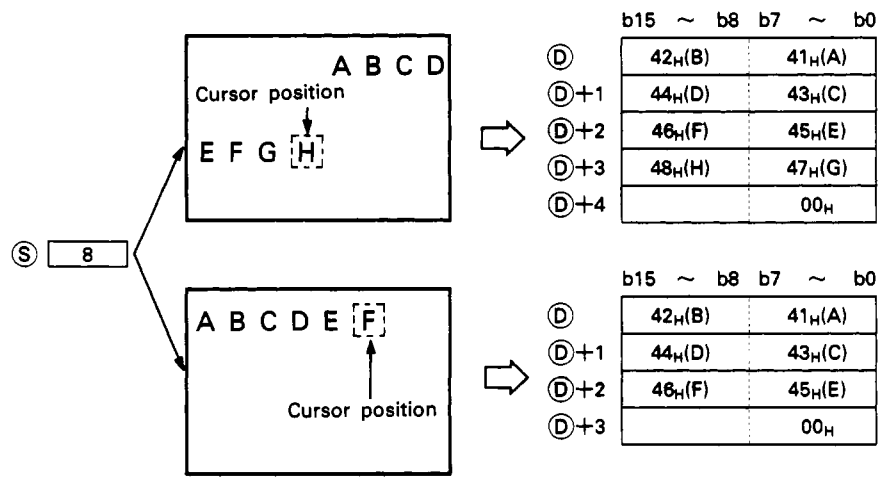
(1) The INPUT instruction is used to convert the ASCII characters which are being displayed on a display unit connected to the AD57(S1)/AD58 designated by ⓝ to corresponding ASCII codes and store them in the devices beginning with the device designated by Ⓓ.
The number of characters to be stored as the ASCII codes, beginning with the cursor position and moving to the left, is designated by Ⓢ.


Ⓢ Number of characters
A B C D E F G H
Cursor position
b15 ~ b8 b7 ~ b0
Ⓓ 42H(B) 41H(A)
Ⓓ+1 44H(D) 43H(C)
Ⓓ+2 46H(F) 45H(E)
Ⓓ+3 48H(H) 47H(G)
Ⓓ+4 00H
Automatically added to the end of stored data

(2) The head I/O number of the AD57(S1)/AD58 designated by ⓝ should be upper 2 digits of 3 hexadecimal digits.
Example) If the AD57(S1)/AD58 is assigned to X.Y120 to 13F, set "12H" at ⓝ.

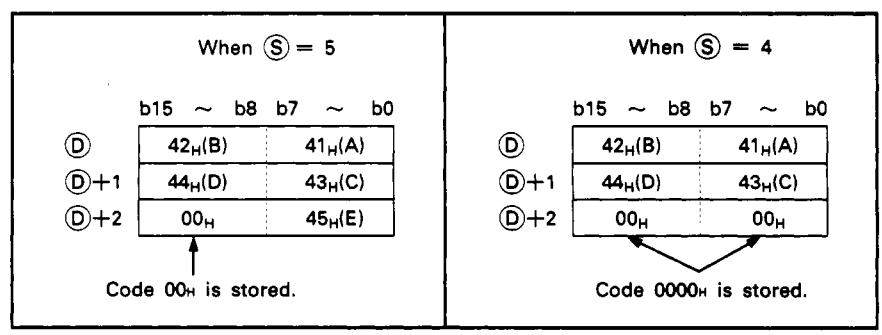
(3) The number of characters to be designated by Ⓢ can be set at any number of characters beginning with the cursor position up to column 0 on line 0.
However, if a value designated by Ⓢ exceeds the last device number of the devices designated by Ⓓ, an error will occur.

(4) If the range of characters designated by Ⓢ beginning with the cursor position exceeds column 0 on a line, the excess range laps around to the last column of the previous line. And, characters in the excess range are converted and stored.
If the designated range exceeds column 0 of line 0 on the screen, only the characters up to column 0 on line 0 are converted and stored.



(5) The ASCII codes to be stored in Ⓓ correspond to designated characters and are within the range of 00H to FFH.
If a designated character corresponds to code 100H or above, it is automatically converted to code 20H (space code) and stored.

(6) Code 00H is automatically stored in the end of the ASCII codes stored in Ⓓ.
The method of storage of code 00H when the number of designated characters is an even number differs from that when the number of designated characters is an odd number, as shown below.

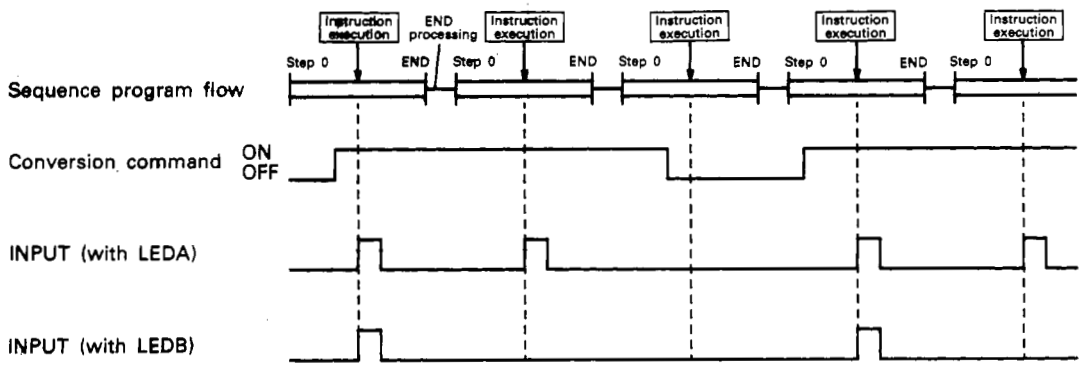


(7) After execution of the INPUT instruction, conditions of the display become as follows.

Item	Condition
Display mode	(no change)
Cursor line position	
Cursor column position	
Head VRAM address displayed	
Normal/reverse designation	
Color designation	
Cursor display	

EXECUTION CONDITION

The INPUT instruction is executed every scan while the conversion command is ON when the LEDA instruction is used. It is executed only once at the leading edge of the conversion command signal when the LEDB instruction is used.



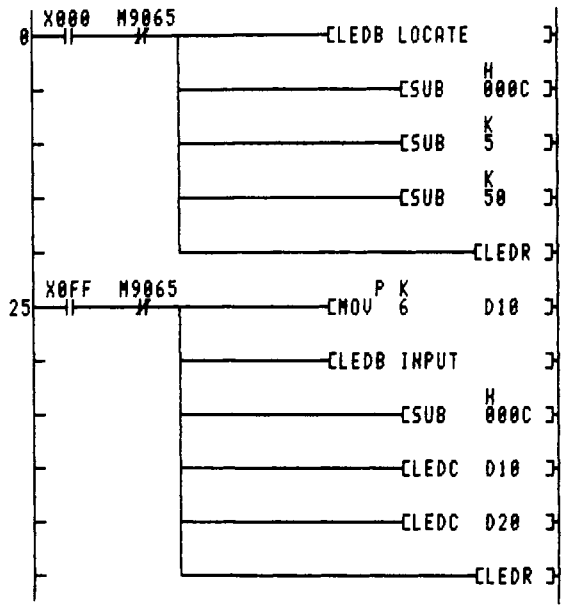
OPERATION ERROR

In the following cases, an operation error occurs and an error flag (M9011) is set.

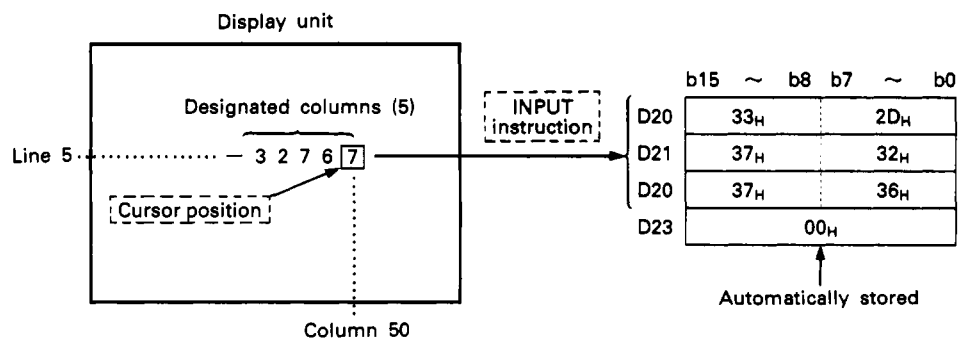
Description	Error Code	
	D9008	D9091
The number of characters designated by Ⓢ is 0 or a negative value. The number of characters to be converted exceeds the last device number of the devices designated by Ⓓ.	50	504

PROGRAM EXAMPLE

The following is an example of the program used to store the ASCII character codes of the characters displayed on a display unit connected to the AD57 loaded at X/Y0C0 to 0FF in designated devices.
Character codes which correspond to the characters displayed at columns 45 to 50 on line 5 are stored in devices D20 to D25.



The INPUT instruction is used for data entry together with other instructions such as CINMP, CINHP, CINPT, CIN (alphanumerics), CINSP and CINCLR. (Refer to Section 7.3 for details.)
By execution of the INPUT instruction, character codes which correspond to the characters within the designated range to the left of the cursor position are stored.



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MEMO

6.9 VRAM Data Read and Write Instructions

The VRAM data read and write instructions are used to read the display data stored in the VRAM areas or to write the display data stored in the VRAM areas.
By use of the VRAM data read and write instructions, display data can be moved in the VRAM areas, and display screen data can be stored.

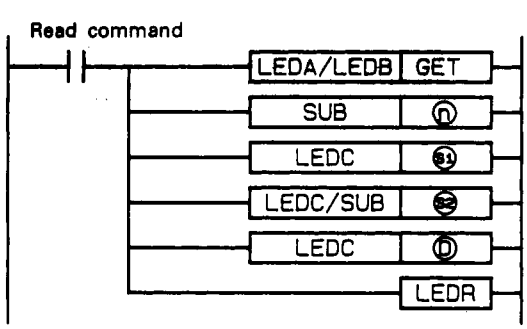
Execute VRAM data read and write by use of the following instructions.

Category	Instruction Name	Description
VRAM data read	GET	Reads designated number of display data from designated addresses of the VRAM areas and stores it in devices.
VRAM data write	PUT	Writes display data stored in devices to designated addresses of the VRAM areas.

6.9.1 VRAM data read·····GET

	Usable devices																			Digit specification	Number of steps	Subset	Index	Carry flag	Error flag
	Bit device							Word (16-bit) device									Constant		Pointer		Level					
	X	Y	M	L	S	B	F	T	C	D	W	R	A0	A1	Z	V	K	H	P	I	N					M9012	M9011
ⓝ																	○	○									
(S1)								○	○	○	○	○															
(S2)								○	○	○	○	○					○	○					26		○		○
Ⓓ								○	○	○	○	○															

*1: The number of steps varies with type of device used. See Section 5.2.



LEDA : Execution at ON
LEDB : Execution at leading edge

LEDC : Device number is designated

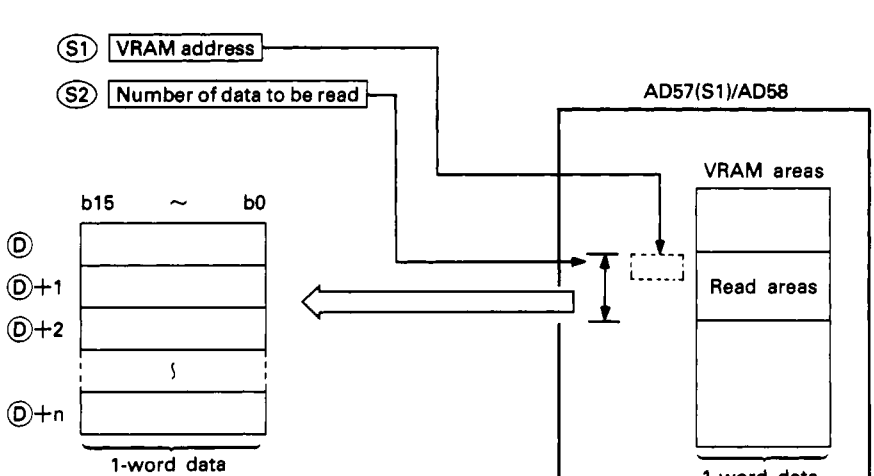
SUB : Constant is designated

Setting data

ⓝ	Head I/O number of AD57
(S1)	Head address of the VRAM areas where display data to be read is stored
(S2)	Number of data to be read
Ⓓ	Head number of the devices which store read data

FUNCTION

(1) The GET instruction is used to read the number of data designated by (S2) beginning with the address designated by (S1) of the VRAM areas of the AD57(S1)/AD58 designated by ⓝ and to store it in the devices designated by Ⓓ.



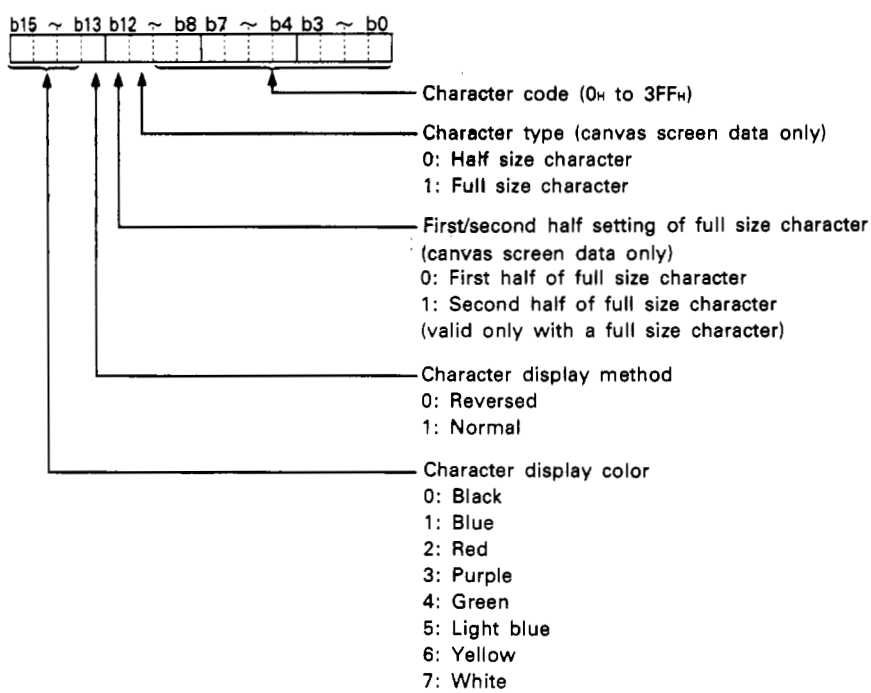
(2) The head I/O number of the AD57(S1)/AD58 designated by ⓝ should be upper 2 digits of 3 hexadecimal digits.
Example) If the AD57(S1)/AD58 is assigned to X/Y120 to 13F, set "12H" at ⓝ.

(3) The VRAM address to be designated by (S1) can be set within the range of −1 to 7679. Setting of "−1" corresponds to the cursor position of the areas being displayed.
(See Section 1.1.1 for detail of the VRAM areas.)

(4) The number of read data to be designated by (S2) can be set at any number within the range of the VRAM address designated by (S1) up to address 7679.
However, a value which exceeds the last device number of the devices designated by Ⓓ cannot be set.

(5) If the range of the number of data designated by (S2) beginning with the address designated by (S1) exceeds address 7679, an error occurs and read processing is not executed.

(6) The figure below describes the data stored in the VRAM areas.

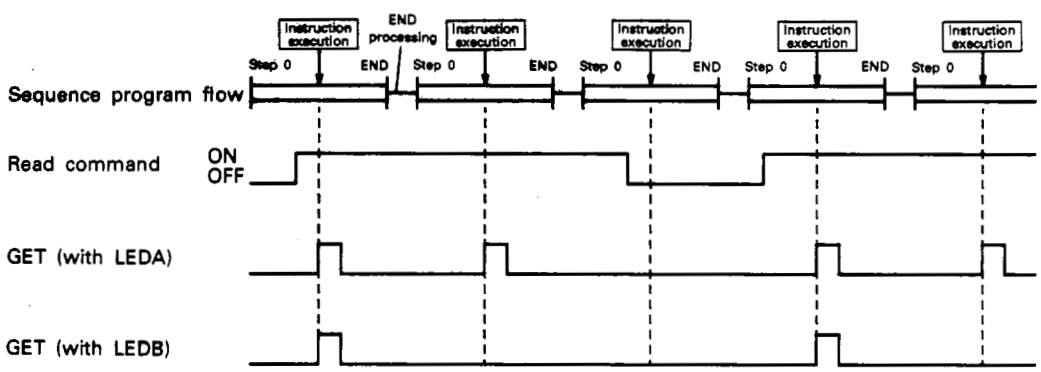

b15 ~ b13 b12 ~ b8 b7 ~ b4 b3 ~ b0
Character code (0H to 3FFH)
Character type (canvas screen data only)
0: Half size character
1: Full size character
First/second half setting of full size character
(canvas screen data only)
0: First half of full size character
1: Second half of full size character
(valid only with a full size character)
Character display method
0: Reversed
1: Normal
Character display color
0: Black
1: Blue
2: Red
3: Purple
4: Green
5: Light blue
6: Yellow
7: White

(7) After execution of the GET instruction, conditions of the display become as follows.

Item	Condition
Display mode	(no change)
Cursor line position	
Cursor column position	
Head VRAM address displayed	
Normal/reverse designation	
Color designation	
Cursor display	

EXECUTION CONDITION

The GET instruction is executed every scan while the read command is ON when the LEDA instruction is used. It is executed only once at the leading edge of the read command signal when the LEDB instruction is used.



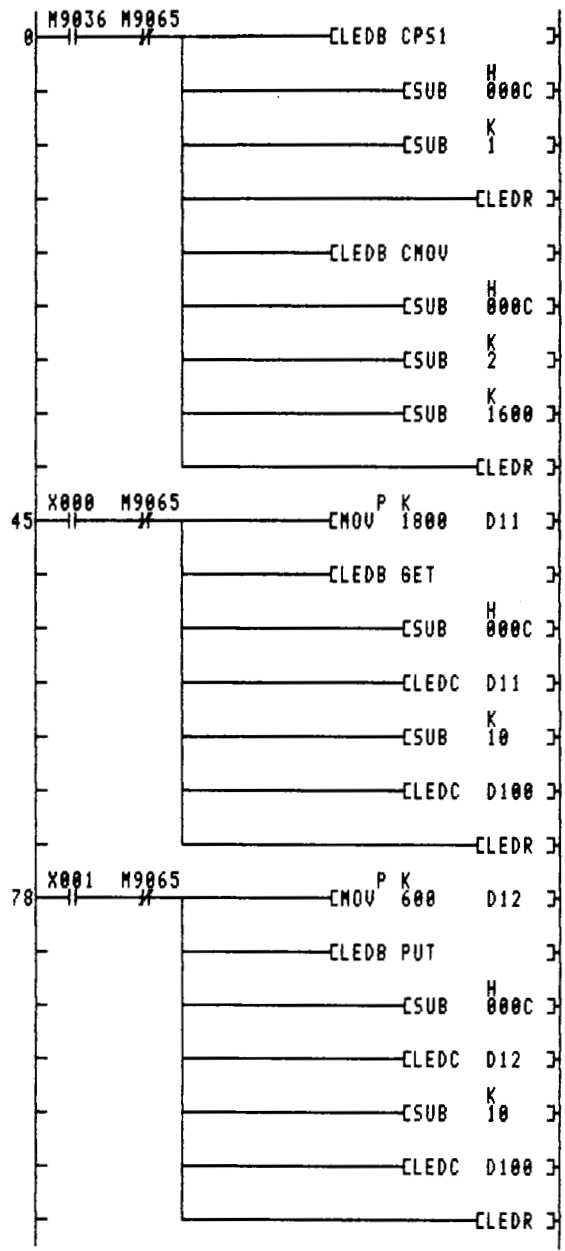
OPERATION ERROR

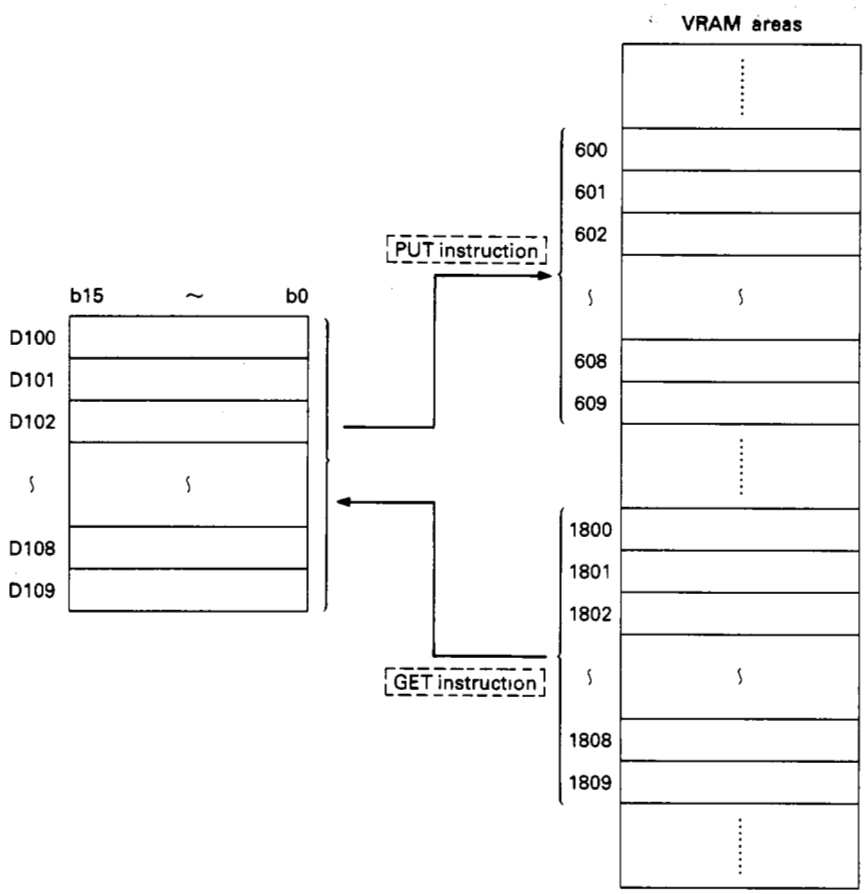
In the following cases, an operation error occurs and an error flag (M9011) is set.

Description	Error Code	
	D9008	D9091
The VRAM area address designated by (S1) is out of the range of −1 to 7679.	50	504
The number of characters designated by (S2) is 0 or a negative value.		
The range of the number of data designated by (S2) beginning with the VRAM area address designated by (S1) exceeds address 7679.		
The range of the number of data designated by (S2) beginning with the device number designated by (D) exceeds the last device number of corresponding device.		

PROGRAM EXAMPLE

The following is an example of the program used to read display data from the VRAM areas of the AD57 loaded at X/Y0C0 to 0FF and to store it in other VRAM areas.
Display data is read from addresses 1800 to 1809 of the VRAM areas and written to addresses 600 to 609.
The read data is written to devices D100 to D109.



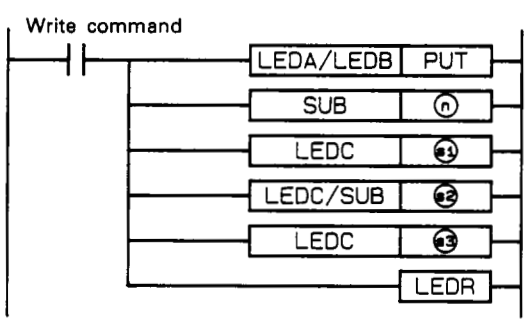

VRAM areas
PUT instruction
GET instruction
b15 ~ b0
D100
D101
D102
D108
D109
600
601
602
608
609
1800
1801
1802
1808
1809

MEMO

6.9.2 VRAM data write·····PUT

	Usable devices																			Digit specification	Number of steps	Subset	Index	Carry flag	Error flag
	Bit device							Word (16-bit) device								Constant		Pointer		Level					
	X	Y	M	L	S	B	F	T	C	D	W	R	A0	A1	Z	V	K	H	P	I	N					M9012	M9011
ⓝ																	○	○									
(S1)								○	○	○	○	○															
(S2)								○	○	○	○	○					○	○					26		○		○
(S3)								○	○	○	○	○															

*1: The number of steps varies with type of device used. See Section 5.2.



LEDA : Execution at ON
LEDB : Execution at leading edge

LEDC : Device number is designated

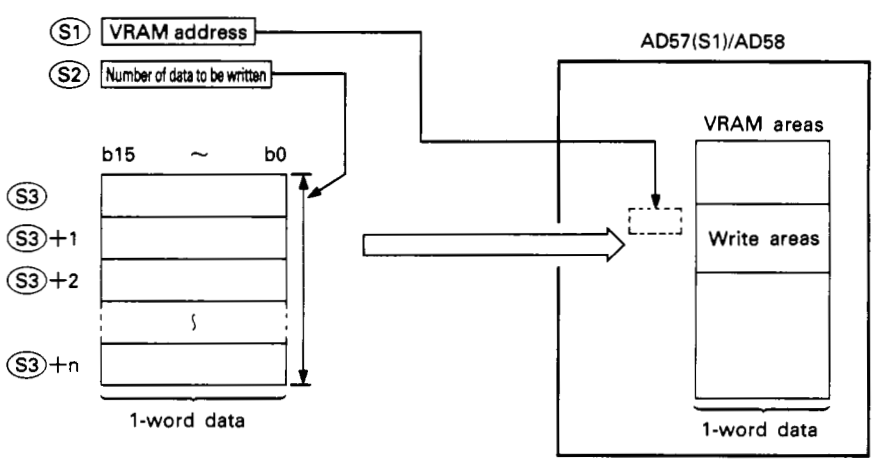
SUB : Constant is designated

Setting data

ⓝ	Head I/O number of AD57
(S1)	Head address of the VRAM areas to where display data is to be written
(S2)	Number of data to be written
(S3)	Head number of the devices which store data to be written

FUNCTION

(1) The PUT instruction is used to write the number of data designated by (S2) beginning with the device number designated by (S3) to the addresses beginning with that designated by (S1) of the VRAM areas of the AD57(S1)/AD58 designated by ⓝ.



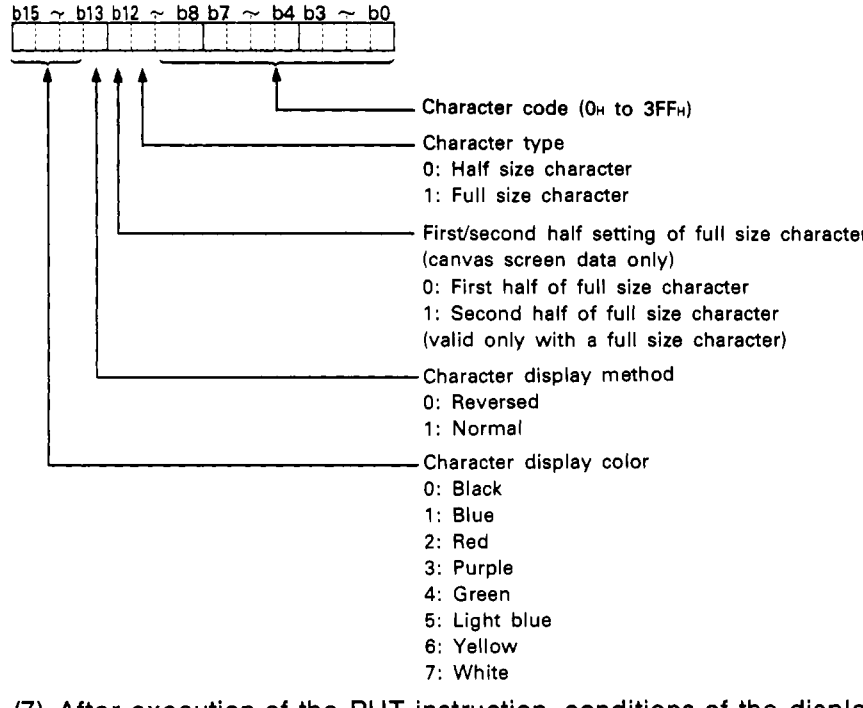
(2) The head I/O number of the AD57(S1)/AD58 designated by (n) should be upper 2 digits of 3 hexadecimal digits.
Example) If the AD57(S1)/AD58 is assigned to X/Y120 to 13F, set "12H" at (n).

(3) The VRAM address to be designated by (S1) can be set within the range of −1 to 7679. Setting of "−1" corresponds to the cursor position of the areas being displayed.
(See Section 1.1.1 for detail of the VRAM areas.)

(4) The number of write data to be designated by (S2) can be set at any number within the range of the VRAM address designated by (S1) up to address 7679.
However, a value which exceeds the last device number of the devices designated by (S3) cannot be set.

(5) If the range of the number of write data designated by (S2) beginning with the address designated by (S1) exceeds address 7679, an error occurs and write processing is not executed.

(6) The figure below describes the data to be stored at the devices designated by (S3) in the VRAM areas.

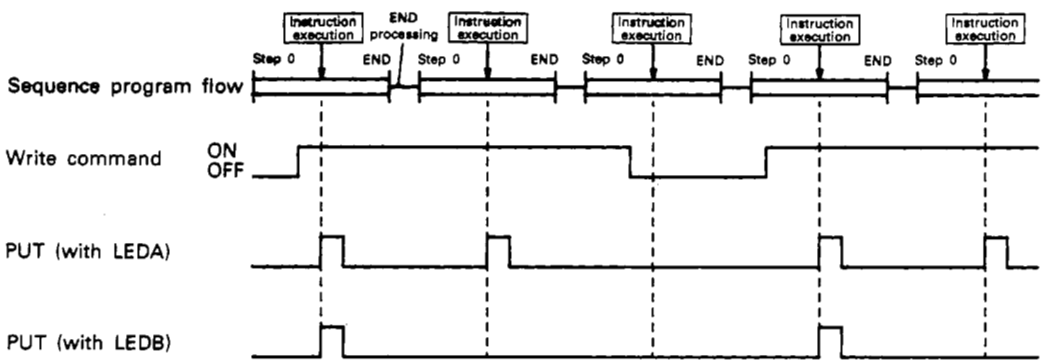


(7) After execution of the PUT instruction, conditions of the display become as follows.

Item	Condition
Display mode	(no change)
Cursor line position	
Cursor column position	
Head VRAM address displayed	
Normal/reverse designation	
Color designation	
Cursor display	

EXECUTION CONDITION

The PUT instruction is executed every scan while the write command is ON when the LEDA instruction is used. It is executed only once at the leading edge of the write command signal when the LEDB instruction is used.



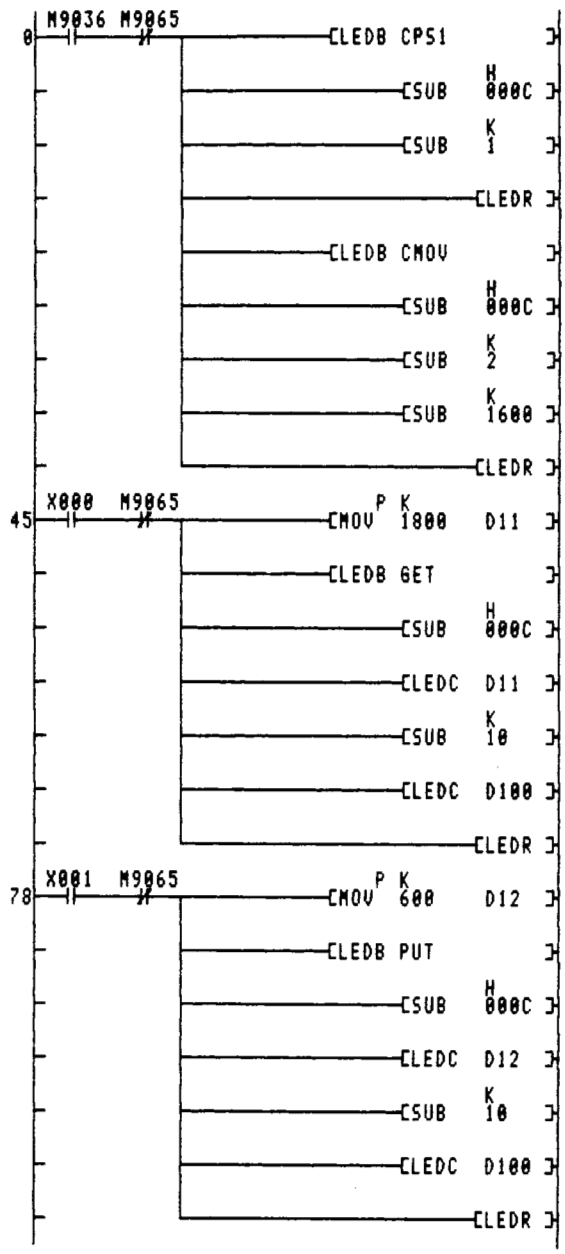
OPERATION ERROR

In the following cases, an operation error occurs and an error flag (M9011) is set.

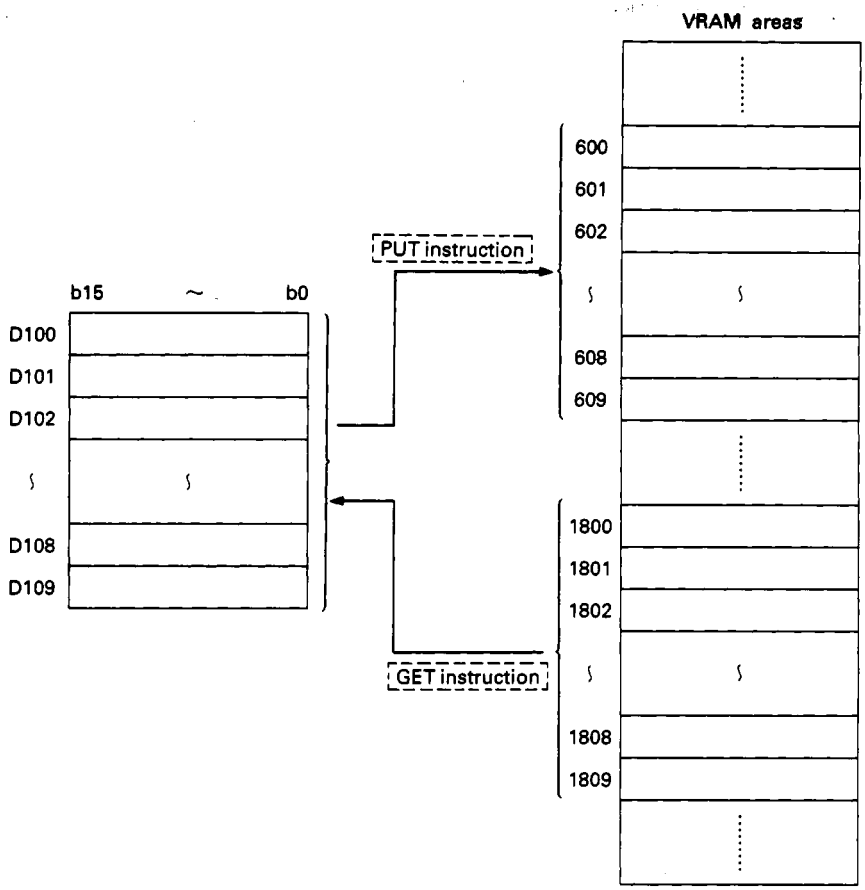
Description	Error Code	
	D9008	D9091
The VRAM area address designated by (S1) is out of the range of −1 to 7679.	50	504
The number of characters designated by (S2) is 0 or a negative value.		
The range of the number of data designated by (S2) beginning with the VRAM area address designated by (S1) exceeds address 7679.		
The range of the number of data designated by (S2) beginning with the device number designated by (S3) exceeds the last device number of corresponding device.		

PROGRAM EXAMPLE

The following is an example of the program used to read display data from the VRAM areas of the AD57 loaded at X/Y0C0 to 0FF and to write it to other VRAM areas.
Display data is read from addresses 1800 to 1809 of the VRAM areas and written to addresses 600 to 609.
The read data is written to devices D100 to D109.



IB (NA) 66257-A


VRAM areas
b15
~
b0
D100
D101
D102
D108
D109
PUT instruction
GET instruction
600
601
602
608
609
1800
1801
1802
1808
1809

6.10 Display State Read Instruction

The display state read instruction is used to read the state of display settings mentioned below.

- Display mode
- Cursor position
- Head VRAM address displayed
- Normal/reverse display
- Color designation
- Cursor display

By use of the display state read instruction, current state of display settings can be checked.

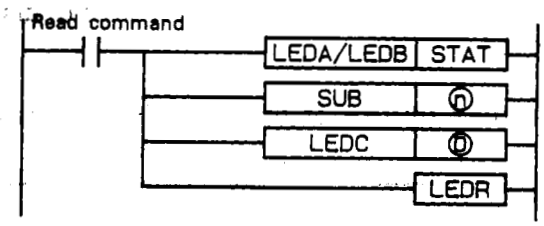
Execute display state read by use of the following instruction.

Category	Instruction Name	Description
Display state read	STAT	Reads the state of display settings.

6.10.1 Display state read·····STAT

	Usable devices																			Digit specification	Number of steps	Subset	Index	Carry flag	Error flag
	Bit device							Word (16-bit) device								Constant		Pointer		Level					
	X	Y	M	L	S	B	F	T	C	D	W	R	A0	A1	Z	V	K	H	P	I	N				M9012	M9011
ⓝ																	○	○								
Ⓓ								○	○	○	○	○											20		○		○

*1: The number of steps varies with type of device used. See Section 5.2.



LEDA : Execution at ON
LEDB : Execution at leading edge

Setting data

ⓝ	Head I/O number of AD57
Ⓓ	Head number of the devices which store read data

FUNCTION

(1) The STAT instruction is used to read the state of display settings of a display unit connected to the AD57(S1)/AD58 designated by ⓝ and to store the data in the devices designated by Ⓓ.

	b15 ~ b0
Ⓓ	Display mode
Ⓓ+1	Cursor line position
Ⓓ+2	Cursor column position
	⟆
Ⓓ+3	Head VRAM address displayed
Ⓓ+4	Normal/reverse designation
Ⓓ+5	Color designation
Ⓓ+6	Cursor display

1-word data

(2) The head I/O number of the AD57(S1)/AD58 designated by ⓝ should be upper 2 digits of 3 hexadecimal digits.
Example) If the AD57(S1)/AD58 is assigned to X/Y120 to 13F, set "12H" at ⓝ.

(3) Data to be stored in devices Ⓓ to Ⓓ+6 are as follows.

1) Display mode (stored in Ⓓ)
Current display mode setting is stored.
- Color CRT standard mode (for AD57) ····· 0000_H
- Monochrome CRT standard mode (for AD57) ····· 0003_H
- Color/monochrome CRT enlarged mode ····· 0101_H
- LCD mode ····· 0202_H
- Color CRT standard mode (for AD57-S1) ····· 0005_H

2) Cursor line position (stored in Ⓓ+1)
The line position where the cursor is set is stored.
- Line 0 to 19

3) Cursor column position (stored in Ⓓ+2)
The column position where the cursor is set is stored.
- Column 0 to 79

4) Head VRAM address displayed (stored in Ⓓ+3)
The head VRAM address of the range being displayed is stored.
- Address 0 to 7679

5) Normal/reverse designation (stored in Ⓓ+4)
Current setting of the normal/reverse display mode is stored.
- Normal display setting ····· 0
- Reverse display setting ····· 1

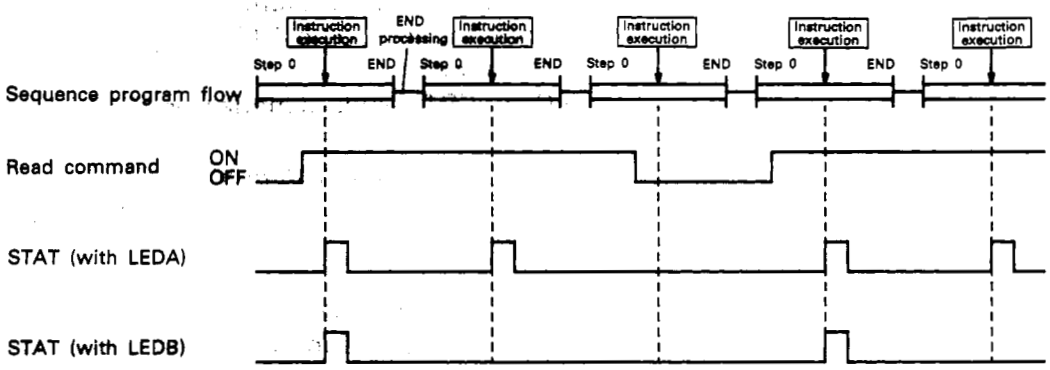
6) Color designation (stored in Ⓓ+5)
Current setting of character color designation is stored.

Set Color	Data Stored	Set Color	Data Stored
Black	0	Green	4
Blue	1	Light blue	5
Red	2	Yellow	6
Purple	3	White	7

7) Cursor display (stored in Ⓓ+6)
Current setting of cursor display is stored.
- Cursor is not displayed ····· 0
- 1-character cursor is displayed ····· 1
- 2-character cursor is displayed ····· 2

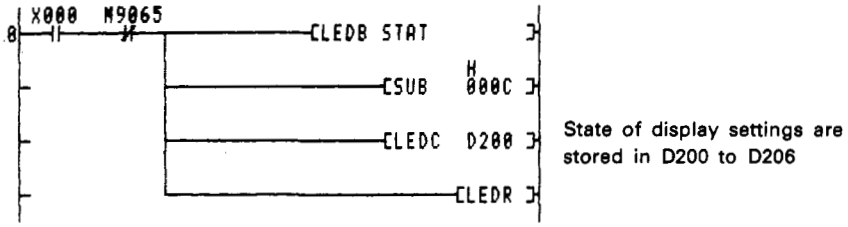
EXECUTION CONDITION

The STAT instruction is executed every scan while the read command is ON when the LEDA instruction is used. It is executed only once at the leading edge of the read command signal when the LEDB instruction is used.



PROGRAM EXAMPLE

The following is an example of the program used to read current state of display settings of a display unit connected to the AD57 loaded at X/Y0C0 to 0FF and to store it in devices D200 to D206.



The STAT instruction stores the state of display settings in seven devices beginning with designated device number.

	b15 ~ b0
D200	Display mode
D201	Cursor line position
D202	Cursor column position
D203	Head VRAM address displayed
D204	Normal/reverse designation
D205	Color designation
D206	Cursor display

7. APPLICATION PROGRAM EXAMPLES

This chapter gives application programs using the instructions which control the AD57(S1)/AD58.

7.1 Initial Processing Program

This section gives an example program used to set the display mode and to clear the screen display/VRAM area.
To display characters to the display unit with the AD57(S1)/AD58, it is necessary to set the display mode to the AD57(S1)/AD58 meeting the display unit to be used. If the display mode does not match the display unit, characters cannot be displayed correctly.
Just after the PC CPU is started up, abnormal data might be stored in the AD57(S1)/AD58 VRAM area causing incorrect display on the display unit.
Therefore, it is recommended to set the display mode and clear the VRAM area after turning on the power supply to the PC CPU.

Programming Conditions

(1) AD57 is used.

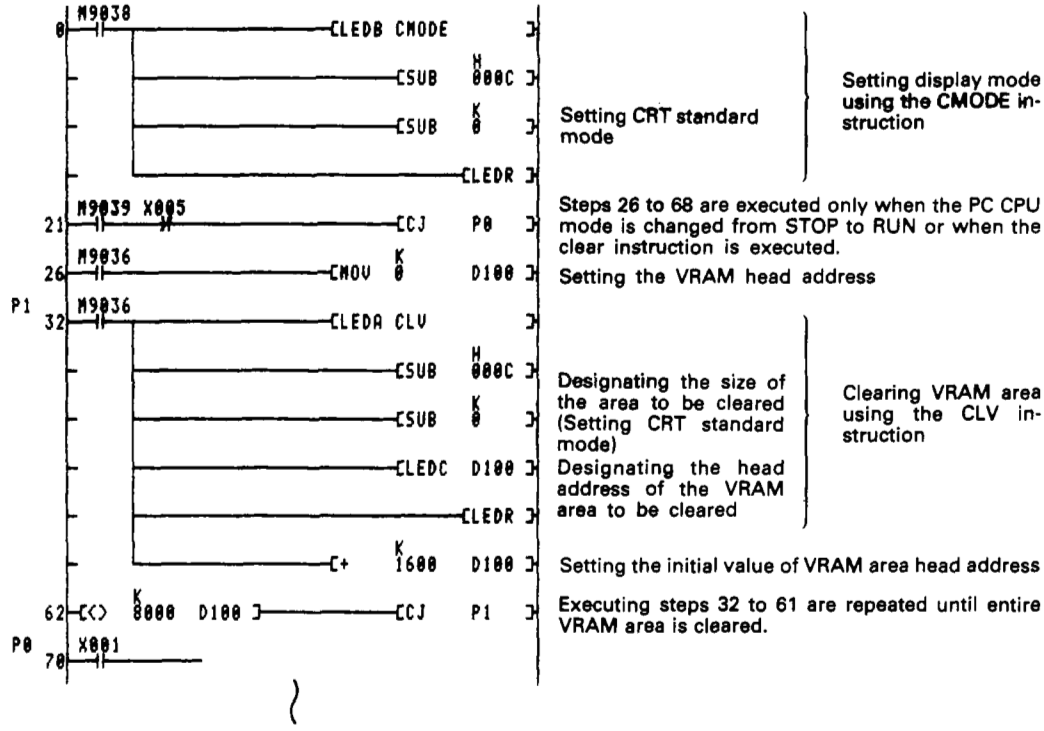
(2) AD57 is loaded to use addresses X/Y0C0 to X/Y0FF.

(3) The CRT standard mode (0) is set as the display mode.

(4) Display mode is set only once when the PC CPU starts running.

(5) VRAM area is cleared when the PC CPU starts running or when X005 is turned ON; the area cleared is from address 0 to address 7679.

Program Example


M9038
CLEDB CMODE
CSUB H 000C
CSUB K 0
CLEDR
Setting CRT standard mode
Setting display mode using the CMODE instruction
M9039 X005
CCJ P0
Steps 26 to 68 are executed only when the PC CPU mode is changed from STOP to RUN or when the clear instruction is executed.
M9036
CMOV K 0 D100
Setting the VRAM head address
P1
M9036
CLEDA CLV
CSUB H 000C
CSUB K 0
CLEDC D100
CLEDR
Designating the size of the area to be cleared (Setting CRT standard mode)
Designating the head address of the VRAM area to be cleared
Clearing VRAM area using the CLV instruction
C+ K 1600 D100
Setting the initial value of VRAM area head address
C<> K 8000 D100
CCJ P1
Executing steps 32 to 61 are repeated until entire VRAM area is cleared.
P0
X001

Explanation

(1) Display mode is automatically set when the PC CPU starts running if unit name has been entered at the time A2ACPU(S1)/A3ACPU parameters are set. In this case, therefore, it is not necessary to set the display mode in a sequence program using the CMODE instruction.
If the unit name has not been entered using a peripheral device, the AD57 CRT standard mode is automatically set. This means that setting of the display mode is not required when the AD57 is used in the CRT standard mode.

(2) VRAM area of addresses 0 to 7679 is cleared in five area clear operations in 1600 address units.
When clearing the VRAM area, an error does not occur if address to be cleared exceed address 7679. Therefore, the VRAM area clear is attempted in the range of address 0 to address 7999 to simplify the program.

(3) Use the CLS instruction to clear only the display screen. The display screen is also cleared using the CLV instruction, by clearing the corresponding VRAM area with the CLV instruction.

7.2 Displaying Canvas Screen

This section gives an example of the program used to display the canvas screen on the display unit.

Programming Conditions

(1) AD57 is used.

(2) AD57 is loaded to use addresses X/Y0C0 to X/Y0FF.

(3) The CRT standard mode (0) is set as the display mode.

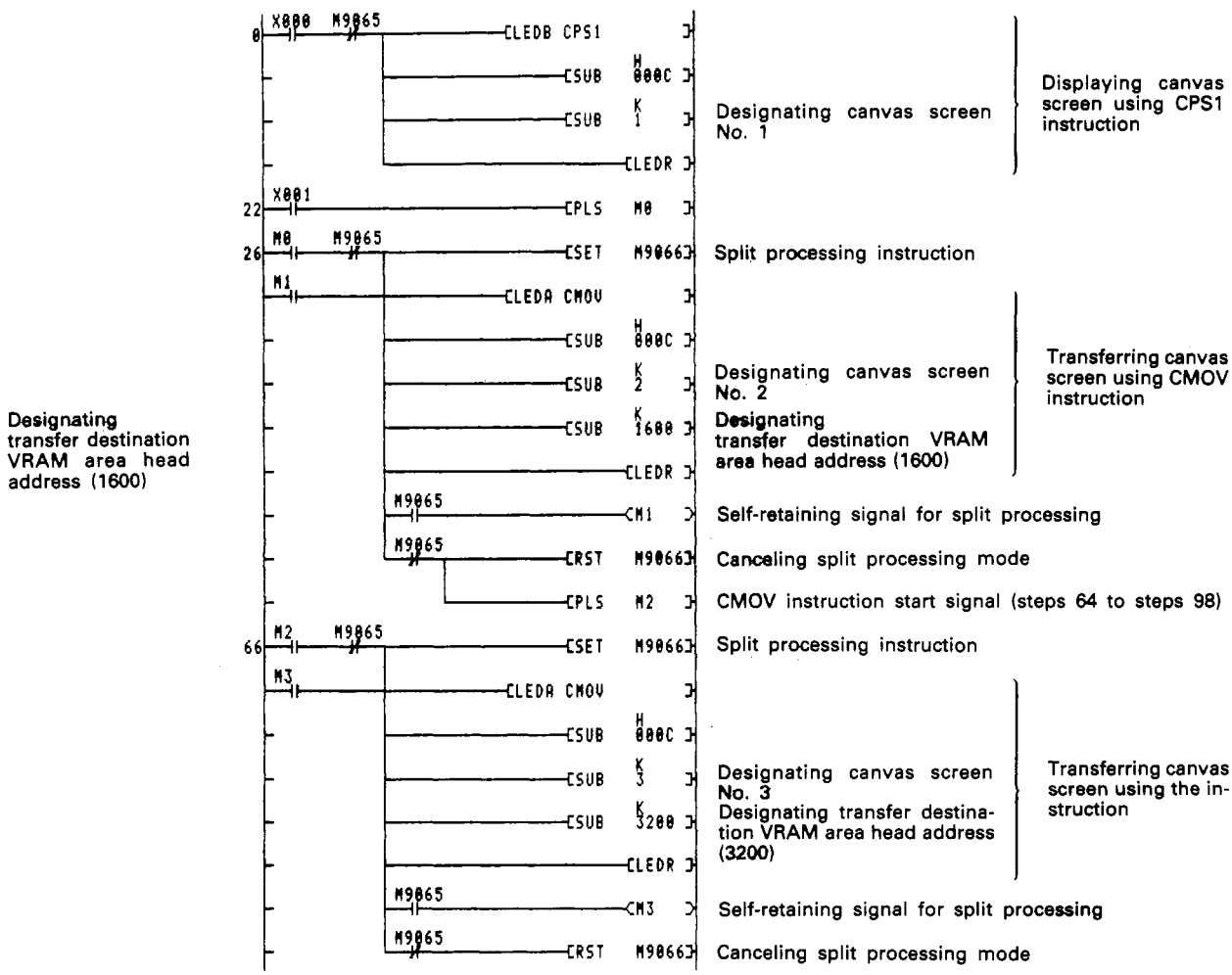
(4) Canvas screen No. 1 displayed on the display unit in batch by turning ON X000.

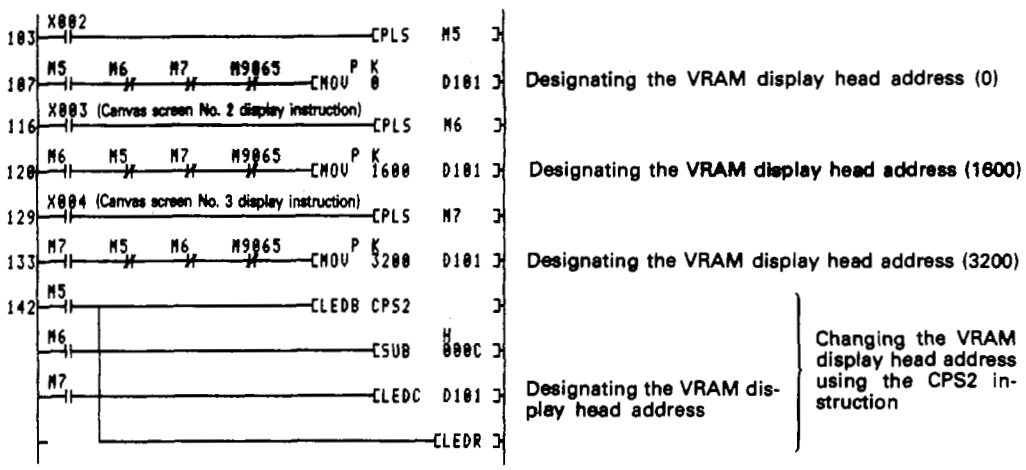
(5) Canvas screen No. 2 and No. 3 are transferred to the VRAM area by turning ON X001 in split processing.

(6) Canvas screen to be displayed is changed according to the input number (X002, X003, X004) that is turned ON.

X002 ON ····· Canvas No. 1 screen is displayed.
X003 ON ····· Canvas No. 2 screen is displayed.
X004 ON ····· Canvas No. 3 screen is displayed.

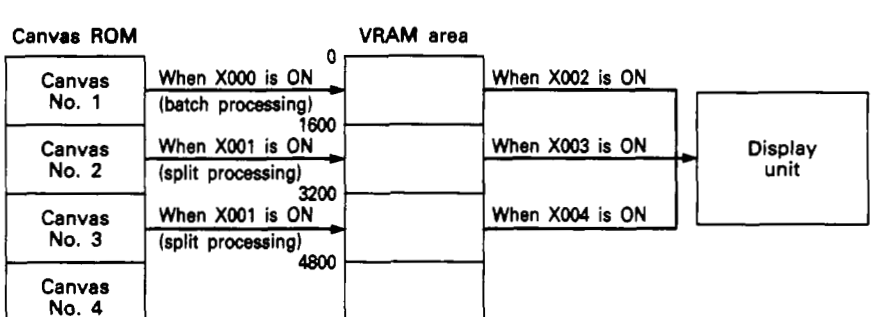
Example Program




X002
CPLS M5
M5 M6 M7 M9065 P K
CMOV 0 D101
Designating the VRAM display head address (0)
X003 (Canvas screen No. 2 display instruction)
CPLS M6
M6 M5 M7 M9065 P K
CMOV 1600 D101
Designating the VRAM display head address (1600)
X004 (Canvas screen No. 3 display instruction)
CPLS M7
M7 M5 M6 M9065 P K
CMOV 3200 D101
Designating the VRAM display head address (3200)
M5
CLEDB CPS2
M6
CSUB H 000C
M7
CLEDC D101
CLEDR
Designating the VRAM display head address
Changing the VRAM display head address using the CPS2 instruction

Explanation

(1) Flow of processing of the example program is shown below.



1) Canvas screen No. 1 in the canvas ROM is transferred to address 0 to address 1599 of the VRAM area when the CPS1 instruction is executed.

2) Canvas screen No. 2 in the canvas ROM is transferred to address 1600 to address 3199 of the VRAM area when the CMOV instruction is executed.

3) Canvas screen No. 3 in the canvas ROM is transferred to address 3200 to address 4700 of the VRAM area when the CMOV instruction is executed.

4) Canvas screen No. 1 stored at address 0 to address 1599 of the VRAM area is displayed using the CPS2 instruction.

5) Canvas screen No. 2 stored at address 1600 to address 3199 of the VRAM area is displayed using the CPS2 instruction.

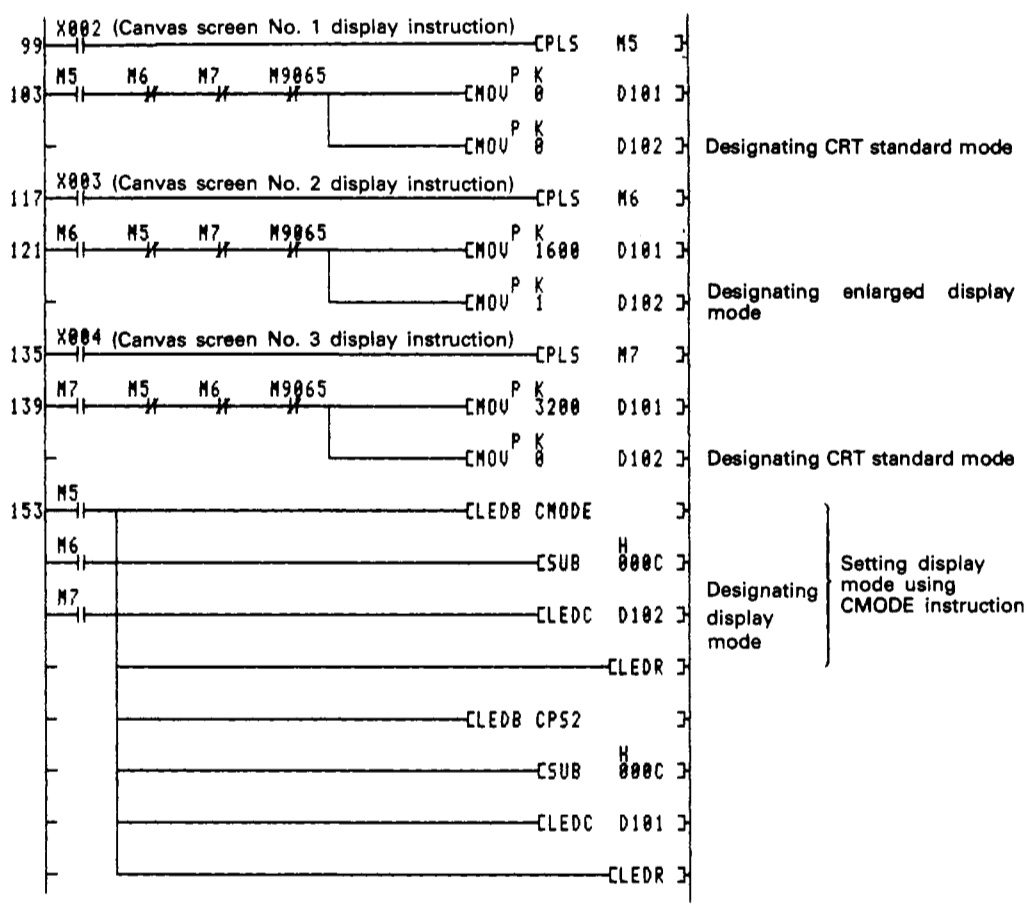
6) Canvas screen No. 3 stored at address 3200 to address 4799 of the VRAM area is displayed using the CPS2 instruction.

(2) Take an interlock with M9065 so that other instructions will not be executed while split transferring of canvas screen No. 2 and No. 3.
It is also necessary to take an interlock so that canvas screen No. 2 and No. 3 will not be transferred at the same time.

(3) To change the screen display modes (CRT standard mode, enlarged display mode) while the AD57 is used, change the display mode by using the display mode setting instruction (CMODE instruction).
If the display mode preset for the canvas screen data and the mode set by a display mode setting instruction differ from each other, correct display cannot be obtained.

Example: Display mode for each canvas screen

Canvas screen No. 1 ····· CRT standard mode (0)
Canvas screen No. 2 ····· Enlarged display mode (1)
Canvas screen No. 3 ····· CRT standard mode (0)



7.3 Setting Data Using Keys

This section gives an example of the program used to input numerical data with the keys on the operation panel connected to the AD57 and to store the data into the PC CPU data register (D).

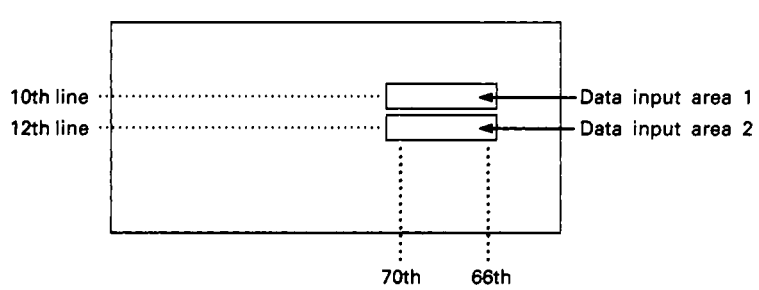
Programming Conditions

(1) AD57 is used.

(2) AD57 is loaded to use addresses X/Y0C0 to X/Y0FF.

(3) The CRT standard mode (0) is set as the display mode.

(4) Data input column positions on the screen are as indicated below.



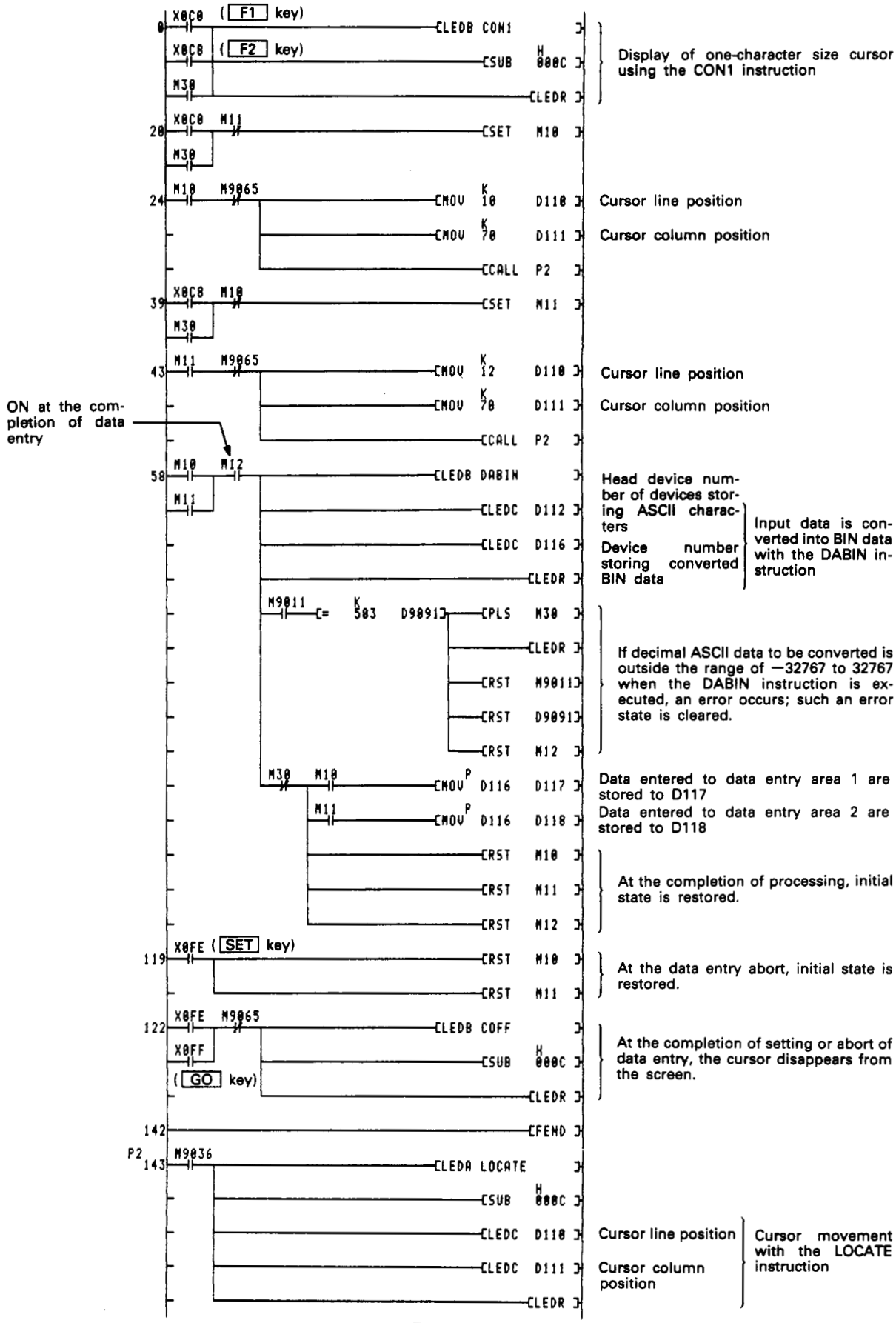
(5) The first place (66th column) of each data input area is used for the entry of a sign.

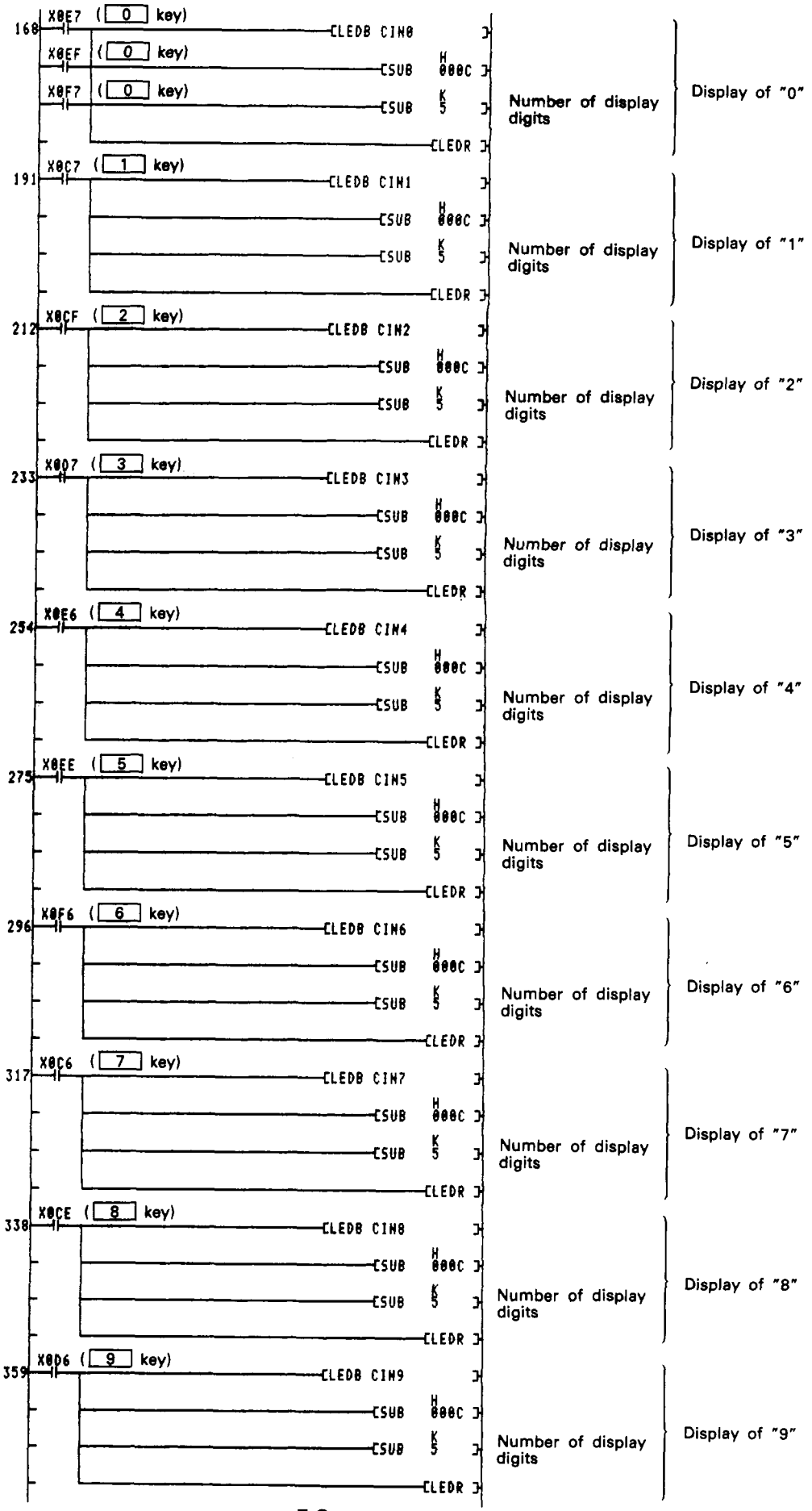
(6) The input data is a decimal consisting of up to 5 digits.

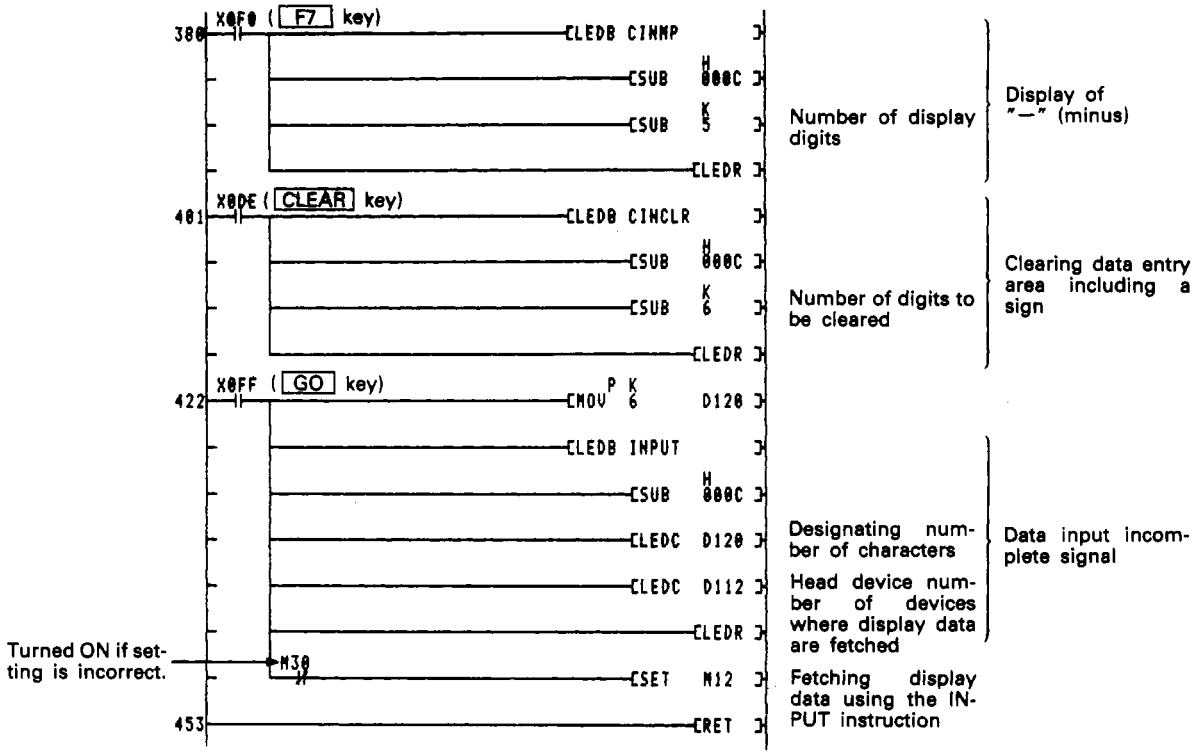
(7) The keys on the operation panel correspond to the input (X) device numbers as shown below.

0 key	X0E7, X0EF, X0F7	9 key	X0D6
1 key	X0C7	F1 key	X0C0 (start of data entry into data input area 1)
2 key	X0CF	F2 key	X0C8 (start of data entry into data input area 2)
3 key	X0D7	F7 key	X0F0 (display of a minus (−) sign)
4 key	X0E6	CLEAR key	X0DE (clearing the data entered to data input area)
5 key	X0EE	GO key	X0FF (end of data entry)
6 key	X0F6	SET key	X0FE (aborting data entry)
7 key	X0C6		
8 key	X0CE		

Program Example



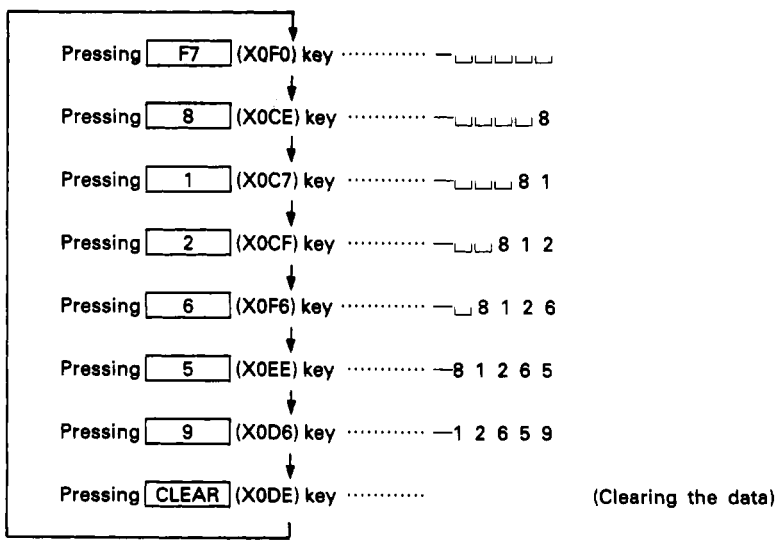

168
X0E7 (0 key)
CLEDB CIN0
X0EF (0 key)
CSUB H 000C
X0F7 (0 key)
CSUB K 5
CLEDR
Number of display digits
Display of "0"
191
X0C7 (1 key)
CLEDB CIN1
CSUB H 000C
CSUB K 5
CLEDR
Number of display digits
Display of "1"
212
X0CF (2 key)
CLEDB CIN2
CSUB H 000C
CSUB K 5
CLEDR
Number of display digits
Display of "2"
233
X0D7 (3 key)
CLEDB CIN3
CSUB H 000C
CSUB K 5
CLEDR
Number of display digits
Display of "3"
254
X0E6 (4 key)
CLEDB CIN4
CSUB H 000C
CSUB K 5
CLEDR
Number of display digits
Display of "4"
275
X0EE (5 key)
CLEDB CIN5
CSUB H 000C
CSUB K 5
CLEDR
Number of display digits
Display of "5"
296
X0F6 (6 key)
CLEDB CIN6
CSUB H 000C
CSUB K 5
CLEDR
Number of display digits
Display of "6"
317
X0C6 (7 key)
CLEDB CIN7
CSUB H 000C
CSUB K 5
CLEDR
Number of display digits
Display of "7"
338
X0CE (8 key)
CLEDB CIN8
CSUB H 000C
CSUB K 5
CLEDR
Number of display digits
Display of "8"
359
X0D6 (9 key)
CLEDB CIN9
CSUB H 000C
CSUB K 5
CLEDR
Number of display digits
Display of "9"



Explanation

(1) By pressing the F1 or F2 key, one-character size cursor is displayed in the designated data entry area, thereby permitting the entry of data.

(2) Keyed in data is displayed in the data entry area in the order as shown below corresponding to the keys pressed.


Pressing F7 (X0F0) key ····· —␣␣␣␣␣
Pressing 8 (X0CE) key ····· —␣␣␣␣8
Pressing 1 (X0C7) key ····· —␣␣␣8 1
Pressing 2 (X0CF) key ····· —␣␣8 1 2
Pressing 6 (X0F6) key ····· —␣8 1 2 6
Pressing 5 (X0EE) key ····· —8 1 2 6 5
Pressing 9 (X0D6) key ····· —1 2 6 5 9
Pressing CLEAR (X0DE) key ·····
(Clearing the data)

(3) After the completion of keying in of the data, press the GO (X0FF) key. Upon receiving the GO key signal, the following processing is executed.

1) Fetching the display data with the INPUT instruction
The data displayed in the data entry area is stored to D120 to D122 in the ASCII code.

Display unit

−12659

	b15 ~ b8	b7 ~ b0
D120	31_H	$2D_H$
D121	36_H	32_H
D122	39_H	35_H

2) Converting the data with the DABIN instruction
The data stored in the ASCII code are converted into binary data and stored to D116.

	b15 ~ b8	b7 ~ b0
D120	31_H	$2D_H$
D121	36_H	32_H
D122	39_H	35_H

	b15 ~ b0
D116	−12659

In the binary data conversion processing using the DABIN instruction, an error occurs if the data to be converted is outside the range of −327678 to 32767 and processing is not executed.

Therefore, the example program is written to detect an error with M9011 and M9091 if the entered data is outside the allowable range (−32768 to 32767). If an error is detected, the data is cleared and the data entry using the operation panel keys is prompted.

7.4 Displaying Characters and Word Device Present Values

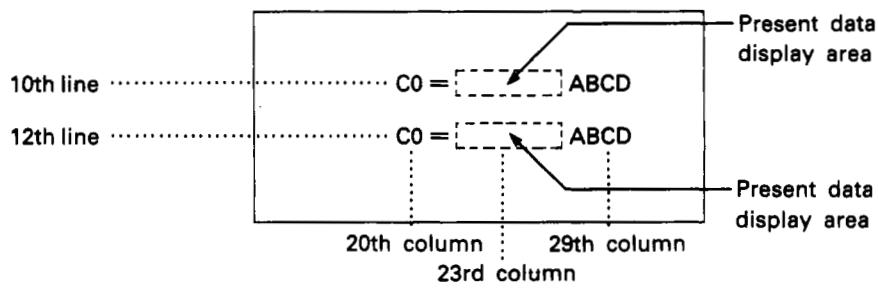
This section gives an example of the program used to display the ASCII characters and the present value of the word devices.

Programming Conditions

(1) AD57 is used.

(2) AD57 is loaded to use addresses X/Y0C0 to X/Y0FF.

(3) Display positions are as indicated below.

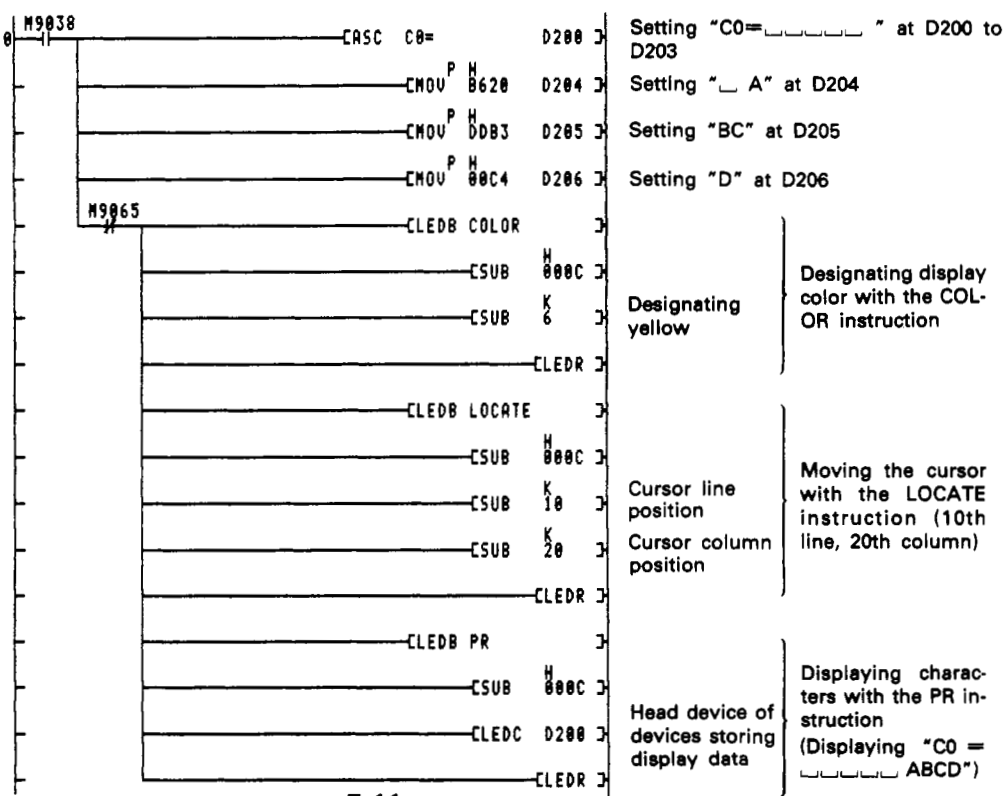


(4) The present data is displayed in up to 6 digits with a sign displayed in the highest digit place (23rd column).

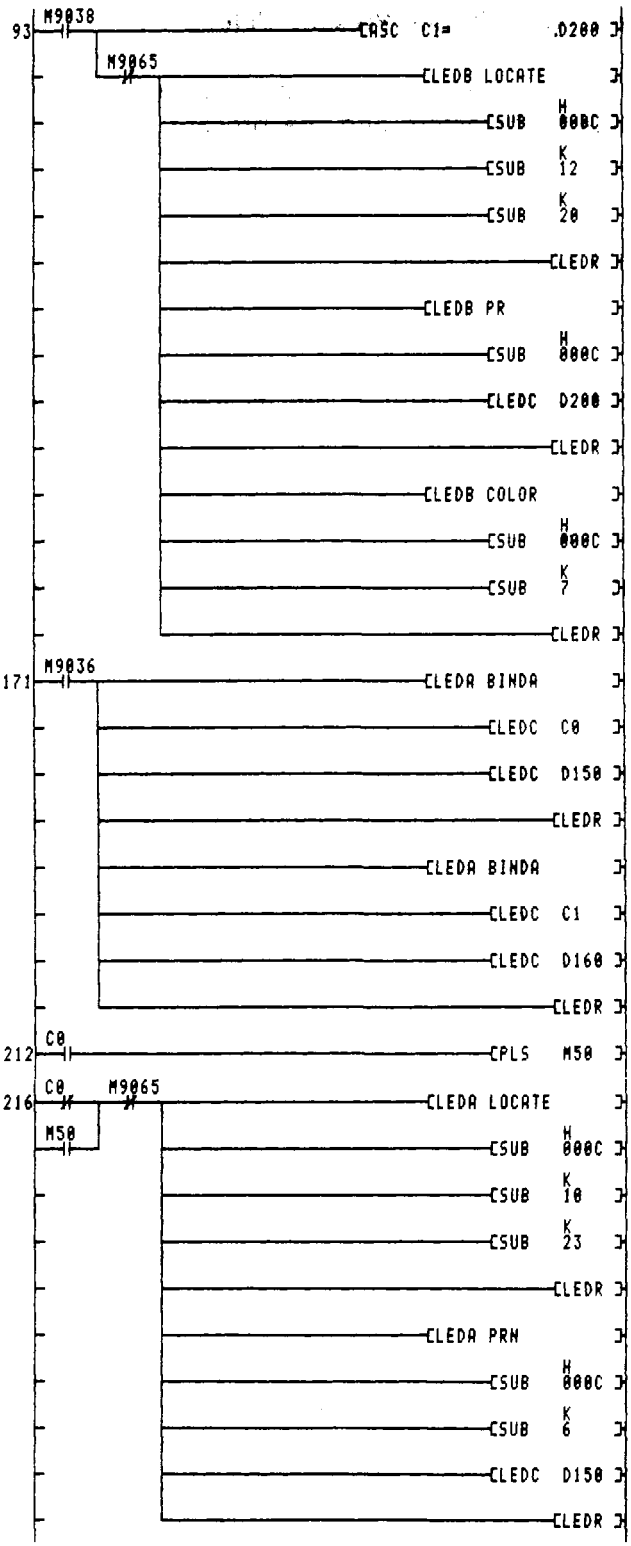
(5) Display is given in yellow for the ASCII characters and in white for present data.

(6) At the count-up of a counter, the present data displayed is highlighted.

Program Example



IB (NA) 66257-A



Changing the data in D200 to D203 to "C1=␣␣␣␣␣"

Cursor line position
Cursor column position

Moving the cursor with the LOCATE instruction (12th line, 20th column)

Head device of devices storing display data

Displaying characters with the PR instruction (Displaying "C1 =␣␣␣␣␣ ABCD")

Designating white

Designating display color with the COLOR instruction

Converting present data of C0 into ASCII character-string with the BINDA instruction; the result of conversion are stored in D150 to D152

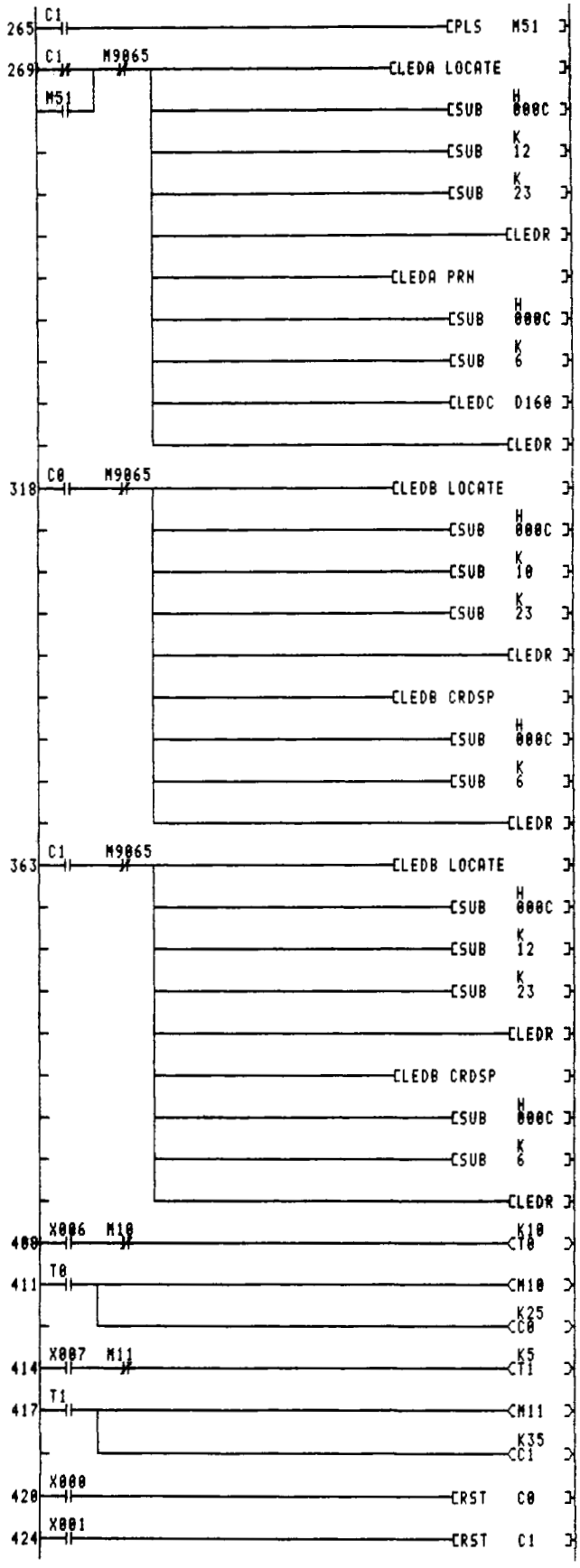
Converting present data of C1 into ASCII character-string with the BINDA instruction; the result of conversion are stored in D160 to D162

Cursor line position
Cursor column position

Moving the cursor with the LOCATE instruction (10th line, 20th column)

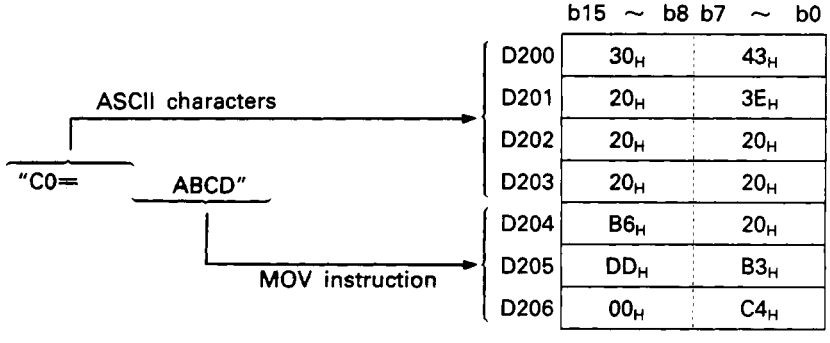
Number of characters to be displayed
Head device of devices storing the characters to be displayed

Displaying present data of C0 with the PRN instruction

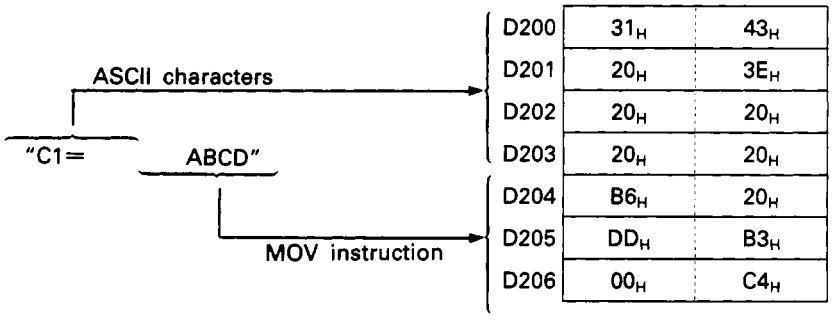

265 C1 CPLS M51
269 C1 M9065 CLEDA LOCATE
M51
CSUB H000C
CSUB K12
CSUB K23
CLEDR
CLEDA PRN
CSUB H000C
CSUB K6
CLEDC D160
CLEDR
318 C0 M9065 CLEDB LOCATE
CSUB H000C
CSUB K10
CSUB K23
CLEDR
CLEDB CRDSP
CSUB H000C
CSUB K6
CLEDR
363 C1 M9065 CLEDB LOCATE
CSUB H000C
CSUB K12
CSUB K23
CLEDR
CLEDB CRDSP
CSUB H000C
CSUB K6
CLEDR
400 X006 M10 K10 CT0
411 T0 CM10 K25 CC0
414 X007 M11 K5 CT1
417 T1 CM11 K35 CC1
420 X000 CRST C0
424 X001 CRST C1
Cursor line position
Cursor column position
Moving the cursor with the LOCATE instruction (12th line, 20th column)
Number of characters to be displayed
Head device of devices storing the characters to be displayed
Displaying present data of C1 with the PRN instruction
Cursor line position
Cursor column position
Moving the cursor with the LOCATE instruction (10th line, 23rd column)
Number of characters to be highlighted
Highlighting the C0 present data with the CRDSP instruction
Cursor line position
Cursor column position
Moving the cursor with the LOCATE instruction (12th line, 23rd column)
Number of characters to be highlighted
Highlighting the C1 present data with the CRDSP instruction
C0 and C1 counting program

Explanation

(1) Set the character code which corresponds to the ASCII characters to be displayed at D200 to D206.



	b15 ~ b8	b7 ~ b0
D200	30_H	43_H
D201	20_H	$3E_H$
D202	20_H	20_H
D203	20_H	20_H
D204	$B6_H$	20_H
D205	DD_H	$B3_H$
D206	00_H	$C4_H$



	b15 ~ b8	b7 ~ b0
D200	31_H	43_H
D201	20_H	$3E_H$
D202	20_H	20_H
D203	20_H	20_H
D204	$B6_H$	20_H
D205	DD_H	$B3_H$
D206	00_H	$C4_H$

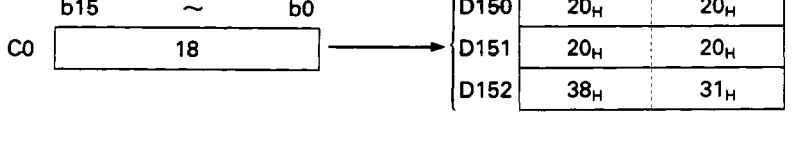
(2) Set the character display color to yellow with the COLOR instruction.

(3) Move the cursor to the position where characters are displayed with the LOCATE instruction.

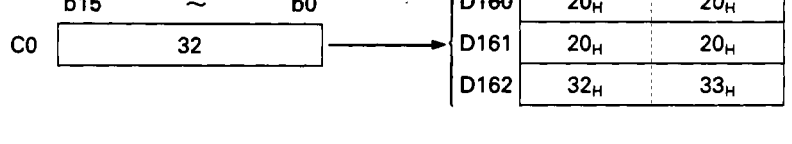
(4) Display the characters corresponding to the ASCII code stored in D200 to D206 with the PR instruction.

(5) Set the character display color to white with the COLOR instruction.

(6) Convert the present data to be displayed into the ASCII code with the BINDA instruction. The conversion results are stored to D150 to D152 and D160 to D162.



	b15 ~ b8	b7 ~ b0
D150	20_H	20_H
D151	20_H	20_H
D152	38_H	31_H



	b15 ~ b8	b7 ~ b0
D160	20_H	20_H
D161	20_H	20_H
D162	32_H	33_H

(7) Move the cursor to the present data display position and present data character-strings, stored in D150 to D152 and D160 to D162, are displayed.

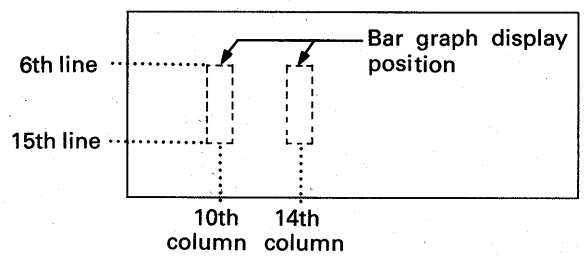
(8) Upon counting-up of the counter, the contact of the corresponding device is turned ON. This highlights the present data currently displayed when the CRDSP instruction is executed.

7.5 Displaying a Bar Graph

This section gives an example of the program used to display a bar graph with bars arranged vertically.

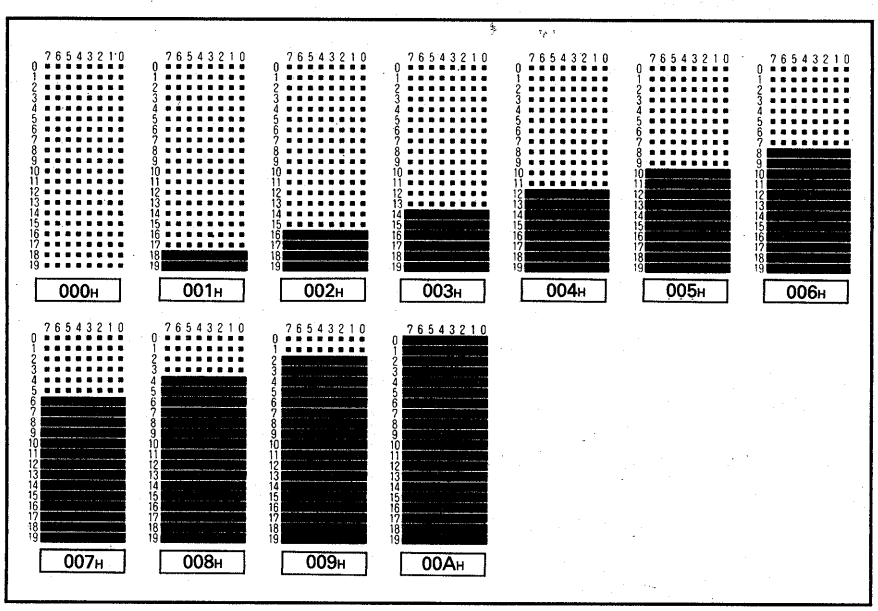
Programming Conditions

(1) AD57 is used.
(2) AD57 is loaded to use addresses X/Y0C0 to X/Y0FF.
(3) Bar graph display position is as indicated below.

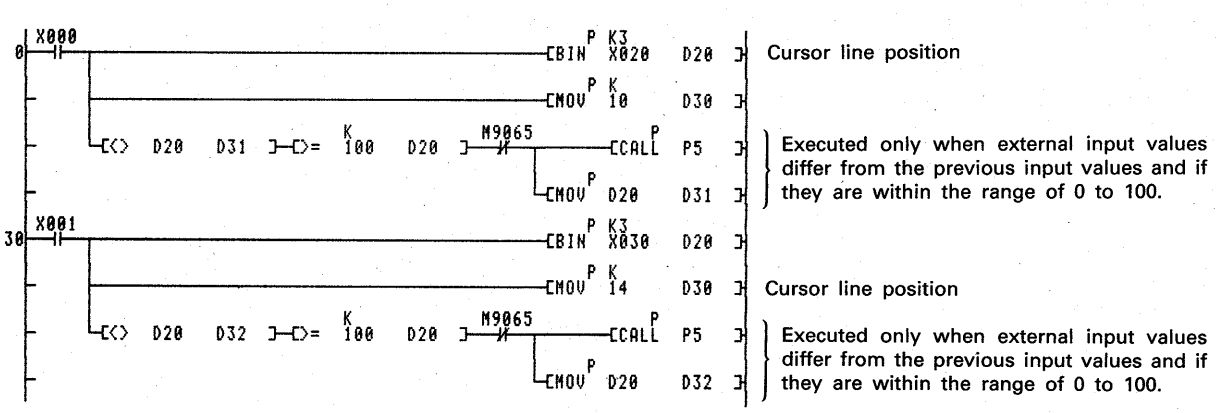


(4) Bar graph display is given for values 0 to 100; 1 division corresponding to 2 dots.

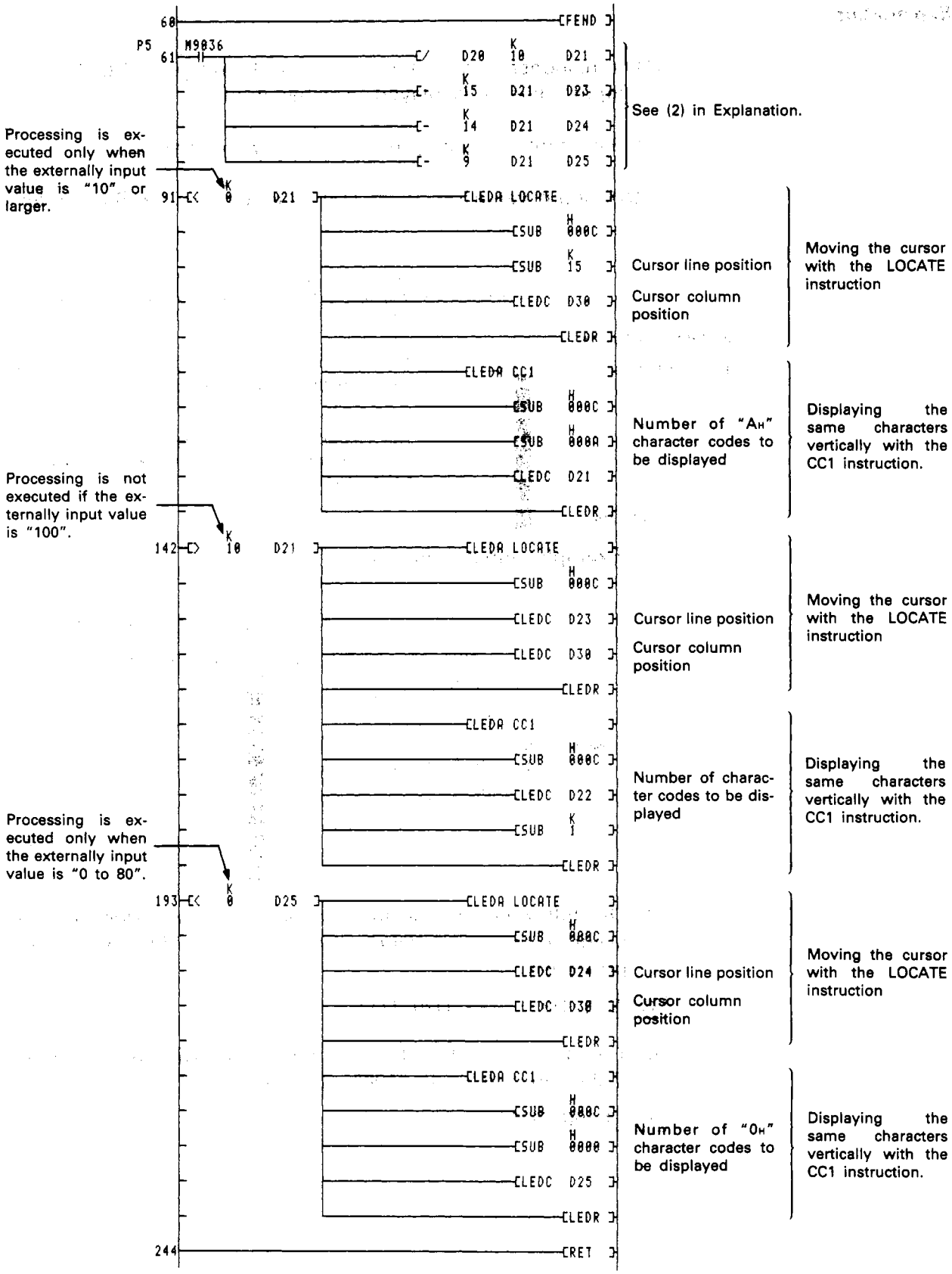
(5) The following characters are used to display a bar graph.



Program Example


X000
CBIN P K3 X020 D20
CMOV P K 10 D30
CMOV P D20 D31
Executed only when external input values differ from the previous input values and if they are within the range of 0 to 100.
X001
CBIN P K3 X030 D20
CMOV P K 14 D30
Cursor line position
CMOV P D20 D32
Executed only when external input values differ from the previous input values and if they are within the range of 0 to 100.

Cursor line position

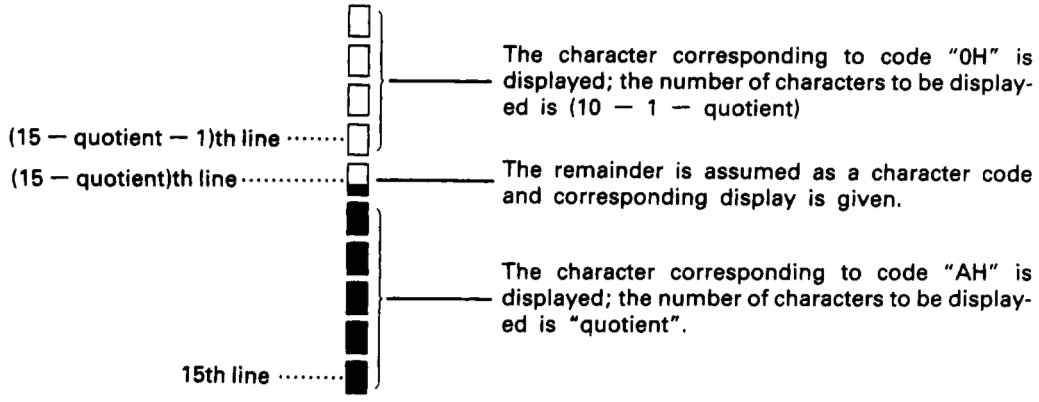

60 FEND
P5 M9036
61
D20 K10 D21
K15 D21 D23
K14 D21 D24
K9 D21 D25
See (2) in Explanation.
Processing is executed only when the externally input value is "10" or larger.
91 K0 D21
CLEDA LOCATE
CSUB H000C
CSUB K15
CLEDC D30
CLEDR
Cursor line position
Cursor column position
Moving the cursor with the LOCATE instruction
CLEDA CC1
CSUB H000C
CSUB H000A
CLEDC D21
CLEDR
Number of "AH" character codes to be displayed
Displaying the same characters vertically with the CC1 instruction.
Processing is not executed if the externally input value is "100".
142 K10 D21
CLEDA LOCATE
CSUB H000C
CLEDC D23
CLEDC D30
CLEDR
Cursor line position
Cursor column position
Moving the cursor with the LOCATE instruction
CLEDA CC1
CSUB H000C
CLEDC D22
CSUB K1
CLEDR
Number of character codes to be displayed
Displaying the same characters vertically with the CC1 instruction.
Processing is executed only when the externally input value is "0 to 80".
193 K0 D25
CLEDA LOCATE
CSUB H000C
CLEDC D24
CLEDC D30
CLEDR
Cursor line position
Cursor column position
Moving the cursor with the LOCATE instruction
CLEDA CC1
CSUB H000C
CSUB H0000
CLEDC D25
CLEDR
Number of "0H" character codes to be displayed
Displaying the same characters vertically with the CC1 instruction.
244 CRET

Explanation

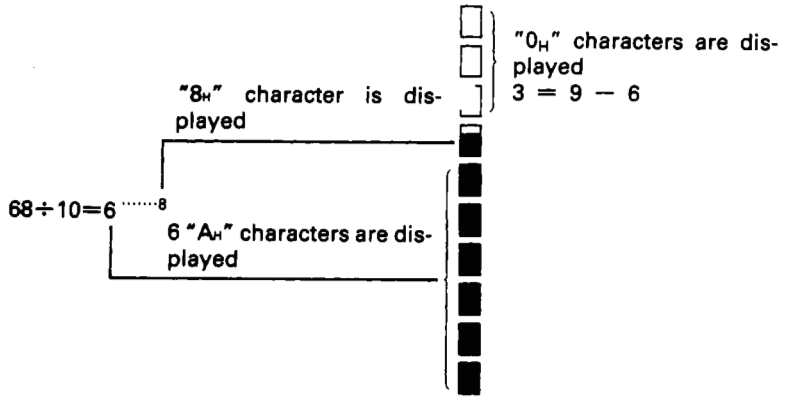
(1) In response to an external input in the range of 0 to 100, the input value is displayed in a bar graph.

(2) Bar graph is displayed in the following manner.

D20 [Input value] ÷ 10 = D21 [Quotient] ··· D22 [Remainder]


The character corresponding to code "0H" is displayed; the number of characters to be displayed is (10 — 1 — quotient)
(15 — quotient — 1)th line
(15 — quotient)th line
The remainder is assumed as a character code and corresponding display is given.
The character corresponding to code "AH" is displayed; the number of characters to be displayed is "quotient".
15th line

Example) Input value of 68



(3) The following are the interlock so that processing will not occur if the input value is the same as the value input previously.

[<>] [D20] [D31] , [<>] [D20] [D32]

(4) The following is the interlock so that processing will not occur if the input value is "100" or larger.

[>=] [K100] [D20]

8. ERROR CODE LISTS

If an error occurs when the PC CPU is switched to the RUN state or in the RUN state, error indication is given or corresponding error code is stored in register D9008, detail error code is stored in register D9091 and error step is stored in register D9011. Refer to Table 8.1 for description, causes and corrective action.

8.1 How to Read Error Codes

When an error has occurred, corresponding error code can be read by use of a peripheral device.
Refer to the Operating Manual of respective peripheral device for the procedure of read of error codes.

8.2 Error Code Lists

The following lists give error messages, error code numbers, detail error code numbers, description, causes and corrective action.

Error Message	Error Code (D9008)	Detailed Error Code (D9091)	Error and Cause	Corrective Action
"INSTRCT CODE ERR." (Checked when STOP→RUN or at execution of instruction.)	10	101	Instruction codes which the CPU cannot decode are included in the program.	(1) Read the error step using a peripheral device and correct the program of the step. (2) Check the ROM if it contains instruction codes which cannot be decoded. If it does, replace it with a correct ROM.
		102	Index qualification is specified for a 32-bit constant.	Read the error step using a peripheral device and correct the program of the step.
		103	Device specified by an extended application instruction is not correct.	
		104	An extended application instruction has incorrect program structure.	
		105	An extended application instruction has incorrect command name.	
		106	Index qualification using Z or V is included in the program between [LEDA/B][IX] and [LEDA/B][IXEND].	
		107	(1) Index qualification is specified for the device numbers and set values in the OUT instruction of timers and counters. (2) Index qualification is specified at the label number of the pointer (P) provided to the head of destination of the [CJ], [SCJ], [CALL], [CALLP], [JMP], [LEDA/B][FCALL] and [LEDA/B][BREAK] instructions or at the label number of the interrupt pointer (I) provided to the head of an interrupt program.	
		108	Errors other than 101 to 107 mentioned above.	

Table 8.1 Error Code List for the A□ACPU (Continue)

Error Message	Error Code (D9008)	Detailed Error Code (D9091)	Error and Cause	Corrective Action
"PARAMETER ERROR" (Checked at power on and at STOP/PAUSE →RUN.)	11	111	Capacity settings of the main and sub programs, microcomputer program, file register comments, status latch, sampling trace and extension file registers are not within the usable range of the CPU.	Read parameters in the CPU memory, check the contents, make necessary corrections and write them again to the memory.
		112	Total of the set capacity of the main and sub programs, file register comments, status latch, sampling trace and extension file registers exceeds capacity of the memory cassette.	Read parameters in the CPU memory, check the contents, make necessary corrections and write them again to the memory.
		113	Latch range set by parameters or setting of M, L or S is incorrect.	
		114	Sum check error	
		115	Either of settings of the remote RUN/PAUSE contact point by parameters, operation mode at occurrence of error, annunciator indication mode, or STOP→RUN indication mode is incorrect.	
		116	The MNET-MINI automatic refresh setting by parameters is incorrect.	
		117	Timer setting by parameters is incorrect.	
		118	Counter setting by parameters is incorrect.	
"MISSING END INS." (Checked at STOP→RUN.)	12	121	The END (FEND) instruction is not given in the main program.	Write the END instruction at the end of the main program.
		122	The END (FEND) instruction is not given in the sub program if the sub program is set by parameters.	Write the END instruction at the end of the sub program.
"CAN'T EXECUTE (P)" (Checked at execution of instruction.)	13	131	The same device number is used at two or more steps for the pointers (P) and interrupt pointers (I) used as labels to be specified at the head of jump destination.	Eliminate the same pointer numbers provided at the head of jump destination.
		132	Label of the pointer (P) specified in the [CJ], [SCJ], [CALL], [CALLP], [JMP], [LEDA/B] [FCALL] or [LEDA/B] [BREAK] instruction is not provided before the END instruction.	Read the error step using a peripheral device, check contents and insert a jump destination pointer (P).

Table 8.1 Error Code List for the A□ACPU (Continue)

Error Message	Error Code (D9008)	Detailed Error Code (D9091)	Error and Cause	Corrective Action
"CAN'T EXECUTE (P)" (Checked at execution of instruction.)	13	133	(1) The [RET] instruction was included in the program and executed though the [CALL] instruction was not given. (2) The [NEXT] and [LEDA/B] [BREAK] instructions were included in the program and executed though the [FOR] instruction was not given. (3) Nesting level of the [CALL], [CALLP] and [FOR] instructions is 6 levels or deeper, and the 6th level was executed. (4) There is no [RET] or [NEXT] instruction at execution of the [CALL] or [FOR] instruction.	(1) Read the error step using a peripheral device, check contents and correct program of the step. (2) Reduce the number of nesting levels of the [CALL], [CALLP] and [FOR] instructions to 5 or less.
		134	The [CHG] instruction was included in the program and executed though no sub program was provided.	Read the error step using a peripheral device and delete the [CHG] instruction circuit block.
		135	(1) [LEDA/B] [IX] and [LEDA] [IXEND] instructions are not paired. (2) There are 33 or more sets of [LEDA/B] [IX] and [LEDA] [IXEND] instructions.	(1) Read the error step using a peripheral device, check contents and correct program of the step. (2) Reduce the number of sets of [LEDA/B] [IX] and [LEDA] [IXEND] instructions to 32 or less.
"CHK FORMAT ERR." (Checked at STOP/PAUSE →RUN.)	14	141	Instructions (including NOP) other than LDX, LDIX, ANDX and ANIX are included in the [CHK] instruction circuit block.	Check the program of the [CHK] instruction and correct it referring to contents of detailed error codes.
		142	Multiple [CHK] instructions are given.	
		143	The number of contact points in the [CHK] instruction circuit block exceeds 150.	
		144	The [LEDA] [CHK] instructions are not paired with the [LEDA] [CHKEND] instructions, or 2 or more pairs of them are given.	
		145	Format of the block shown below, which is provided before the [CHK] instruction circuit block, is not as specified. P254 ⊣⊢—[CJ] [P□□□]⊣	
		146	Device number of D1 in the [CHK] [D1] [D2] instruction is different from that of the contact point before the [CJP] instruction.	
		147	Index qualification is used in the check pattern circuit.	

Table 8.1 Error Code List for the A□ACPU (Continue)

Error Message	Error Code (D9008)	Detailed Error Code (D9091)	Error and Cause	Corrective Action
"CHK FORMAT ERR." (Checked at STOP/PAUSE →RUN.)	14	148	(1) Multiple check pattern circuits of the [LEDA][CHK] ~ [LEDA][CHKEND] instructions are given. (2) There are 7 or more check condition circuits in the [LEDA][CHK] ~ [LEDA][CHKEND] instructions. (3) The check condition circuits in the [LEDA][CHK] ~ [LEDA][CHKEND] instructions are written without using X and Y contact instructions or compare instructions. (4) The check pattern circuits of the [LEDA][CHK] ~ [LEDA][CHKEND] instructions are written with 257 or more steps.	
"CAN'T EXECUTE (1)" (Checked at occurrence of interrupt.)	15	151	The [IRET] instruction was given outside of the interrupt program and was executed.	Read the error step using a peripheral device and delete the [IRET] instruction.
		152	There is no [IRET] instruction in the interrupt program.	Check the interrupt program if the [IRET] instruction is given in it. Write the [IRET] instruction if it is not given.
		153	Though an interrupt module is used, no interrupt pointer (I) which corresponds to the module is given in the program. Upon occurrence of error, the problem pointer (I) number is stored at D9011.	Monitor special register D9011 using a peripheral device, and check if the interrupt program that corresponds to the stored data is provided or if two or more interrupt pointers (I) of the same number are given. Make necessary corrections.
"CASSETTE ERROR"	16	—	Memory cassette is not loaded.	Turn off the PC power and load the memory cassette.
"RAM ERROR" (Checked at power on.)	20	201	The sequence program storage RAM in the CPU module caused an error.	Since this is CPU hardware error, consult Mitsubishi representative.
		202	The work area RAM in the CPU module caused an error.	
		203	The device memory in the CPU module caused an error.	
		204	The address RAM in the CPU module caused an error.	
"OPE. CIRCUIT ERROR" (Checked at power on.)	21	211	The operation circuit for index qualification in the CPU does not work correctly.	Since this is CPU hardware error, consult Mitsubishi representative.
		212	Hardware (logic) in the CPU does not operate correctly.	
		213	The operation circuit for sequential processing in the CPU does not operate correctly.	

Table 8.1 Error Code List for the A□ACPU (Continue)

Error Message	Error Code (D9008)	Detailed Error Code (D9091)	Error and Cause	Corrective Action
"WDT ERROR" (Checked at execution of END processing.)	22	—	Scan time is longer than the WDT time. (1) Scan time of the user's program has been extended due to certain conditions. (2) Scan time has been extended due to momentary power failure occurred during scanning.	(1) Check the scan time of the user's program and shorten it using the CJ instructions. (2) Monitor contents of special register D9005 using a peripheral device. If the contents are other than 0, power supply voltage may not be stable. Check power supply and reduce variation in voltage.
"END NOT EXECUTE" (Checked at execution of the END instruction.)	24	241	Whole program of specified program capacity was executed without executing the END instructions. (1) When the END instruction was to be executed, the instruction was read as other instruction code due to noise. (2) The END instruction changed to other instruction code due to unknown cause.	(1) Reset and run the CPU again. If the same error recurs, Since this is CPU hardware error, consult Mitsubishi representative.
"MAIN CPU DOWN"	26	—	The main CPU is malfunctioning or faulty.	Since this is CPU hardware error, consult Mitsubishi representative.
"UNIT VERIFY ERR." (Checked continuously.)	31	—	Current I/O module information is different from that recognized when the power was turned on. (1) The I/O module (including special function modules) connection became loose or the module was disconnected during operation, or wrong module was connected.	Read detailed error code using a peripheral device and check or replace the module which corresponds to the data (I/O head number). Or, monitor special registers D9116 to D9123 using a peripheral device and check or replace the modules if corresponding data bit is "1".
"FUSE BREAK OFF" (Checked continuously.)	32	—	There is an output module of which fuse is blown.	(1) Check the FUSE BLOWN indicator LED on the output module and replace the fuse. (2) Read detailed error code using a peripheral device and replace the fuse of the output module which corresponds to the data (I/O head number). Or, monitor special registers D9100 to D9107 using a peripheral device and replace the fuse of the output module of which corresponding data bit is "1".
"CONTROL-BUS ERR."	40	401	Due to the error of the control bus which connects to special function modules, the FROM/TO instruction cannot be executed.	Since it is a hardware error of special function module, CPU module or base module, replace and check defective module(s). Consult Mitsubishi representative for defective modules.
		402	If parameter I/O assignment is being executed, special function modules are not accessible at initial communication. At error occurrence, the head I/O number (upper 2 digits of 3 digits) of the special function module that caused error is stored at D9011.	

Table 8.1 Error Code List for the A□ACPU (Continue)

Error Message	Error Code (D9008)	Detailed Error Code (D9091)	Error and Cause	Corrective Action
"SP. UNIT DOWN"	41	411	Though an access was made to a special function module at execution of the FROM/TO instruction, no response is received.	Since it is hardware error of the special function module to which an access was made, consult Mitsubishi representative.
		412	If parameter I/O assignment is being executed, no response is received from a special function module at initial communication. At error occurrence, the head I/O number (upper 2 digits of 3 digits) of the special function module that caused error is stored at D9011.	
"LINK UNIT ERROR"	42	—	Either AJ71R22 or AJ71P22 is loaded to the master station.	Remove either AJ71R22 or AJ71P22 from the master station.
"I/O INT. ERROR"	43	—	Though the interrupt module is not loaded, an interrupt occurred.	Since it is hardware error of a module, replace and check a defective module. For defective modules, consult Mitsubishi representative.
"SP. UNIT LAY. ERR."	44	441	A special function module is assigned as an I/O module, or vice versa, in the I/O assignment using parameters from the peripheral device.	Execute I/O assignment again using parameters from the peripheral device according to the loading status of special function modules.
		442	There are 9 or more special function modules (except AI61(S1)) which can execute interruption to the CPU module loaded.	Reduce the special function modules (except AI61(S1)) which can execute interrupt start to 8 or less.
		443	There are 2 or more AJ71P22 or AJ71R22 modules loaded.	Reduce the AJ71P22 or AJ71R22 modules to 1 or less.
		444	There are 7 or more modules such as a computer link module loaded to one CPU module.	Reduce the computer link modules to 6 or less.
		445	There are 2 or more AI61(S1) modules loaded.	Reduce the AI61 module to 1.
		446	Modules assigned by parameters for MNTMINI automatic refresh from the peripheral device do not conform with the types of station modules actually linked.	Perform again module assignment for MNTMINI automatic refresh with parameters according to actually linked station modules.
		447	The number of modules of I/O assignment registration (number of loaded modules) per one CPU module for the special function modules which can use dedicated instructions is larger than the specified limit. (Total of the number of computers shown below is larger than 1344.) (AD59 × 5) (AD57(S1)/AD58 × 8) (AJ71C24(S3) × 10) (AJ71C21(S1) × 29) + (AJ71PT32(S3) × 125) Total > 1344	Reduce the number of loaded special function modules.

Table 8.1 Error Code List for the A□ACPU (Continue)

Error Message	Error Code (D9008)	Detailed Error Code (D9091)	Error and Cause	Corrective Action
"SP. UNIT ERROR" (Checked at execution of the FROM/TO instruction or the dedicated instructions for special function modules.)	46	461	Module specified by the FROM/TO instruction is not a special function module.	Read the error step using a peripheral device and check and correct contents of the FROM/TO instruction of the step.
		462	Module specified by the dedicated instruction for special function module is not a special function module or not a corresponding special function module.	Read the error step using a peripheral device and check and correct contents of the dedicated instruction for special function modules of the step.
"LINK PARA. ERROR"	47	——	(1) Data written to the parameter areas of the link of which range was set by parameters using a peripheral device does not conform with the data of link parameters read by the CPU. Or, link parameters are not written. (2) Total number of local stations is set at 0.	(1) Write in parameters again and check. (2) If the same error indication is given again, it is hardware failure. Consult Mitsubishi representative.
"OPERATION ERROR" (Checked at execution of instruction.)	50	501	(1) When file registers (R) are used, operation is executed outside of specified ranges of device numbers and block numbers of file registers (R). (2) File registers are used in the program without setting capacity of file registers.	Read the error step using a peripheral device and check and correct program of the step.
		502	Combination of the devices specified by instruction is incorrect.	
		503	Stored data or constant of specified device is not in the usable range.	
		504	Set number of data to be handled is out of the usable range.	
		505	(1) Station number specified by the LEDA/B LRDP, LCDA/B LWTP, LRDP, LWTP instructions is not a local station. (2) Head I/O number specified by the LEDA/B RFRP, LEDA/B RTOP, RFRP, RTOP instructions is not of a remote station.	
		506	Head I/O number specified by the LEDA/B RFRP, LEDA/B RTOP, RFRP, RTOP instructions is not of a special function module.	
		507	(1) When the AD57(S1) or AD58 was executing instructions in divided processing mode, other instructions were executed to either of them. (2) When an AD57(S1) or AD58 was executing instructions in divided processing mode, other instructions were executed in divided mode to another AD57(S1) or AD58.	Read the error step using a peripheral device and provide interlock with special relay M9066 or modify program structure so that, when the AD57(S1) or AD58 is executing instructions in divided processing mode, other instructions may not be executed to either of them or to another AD57(S1) or AD58 in divided mode.

Table 8.1 Error Code List for the A□ACPU (Continue)

Error Message	Error Code (D9008)	Detailed Error Code (D9091)	Error and Cause	Corrective Action
"OPERATION ERROR" (Checked at execution of instruction.)	50	509	(1) An instruction which cannot be executed by remote terminal modules connected to the MNETMINI-S3 was executed to the modules. (2) When the PRC instruction was executed to a remote terminal, the communication request registration areas overflowed. (3) The PIDCONT instruction was executed without executing the PIDINIT instruction. The PID57 instruction was executed without executing the PIDINIT or PIDCONT instruction.	(1) Read the error step using a peripheral device and correct the program, meeting loaded conditions of remote terminal modules. (2) Provide interlock using M9081 (communication request registration areas BUSY signal) or D9081 (number of vacant areas in the communication request registration areas) when the PRC instruction is executed to a remote terminal. (3) Execute the PIDCONT instruction after execution of the PIDINIT instruction. Execute the PID57 instruction after execution of the PIDINIT and PIDCONT instructions.
"MAIN CPU DOWN"	60	——	(1) An interrupt (INT) instruction is used in the microcomputer program. (2) The CPU malfunctioned due to noise. (3) Hardware failure.	(1) Delete the INT instruction from the microcomputer program since it is unusable. (2) Take proper countermeasures for noise. (3) Hardware failure.
"BATTERY ERROR" (Checked at power on.)	70		(1) Battery voltage has lowered below specified level. (2) Battery lead connector is not connected.	(1) Replace battery. (2) If a RAM memory or power failure compensation function is used, connect the lead connector.

Table 8.1 Error Code List for the A□ACPU

APPENDIX

Appendix 1 Processing Time Lists

The following lists give the processing time required for the A2ACPU(S1)/A3ACPU to execute the AD57(S1)/AD58 control instructions.

POINT

The processing time given in the following lists has been measured under the conditions mentioned below. The processing time may vary with type of module and operation mode to be used.
The AD57 module is used.
The CRT standard mode is set.
The cursor is not displayed.

Category	Instruction Name	Condition	Processing Time (μ sec)	
			A3ACPU	A2ACPU
Display mode setting instruction	CMODE		794	851
Display screen control instructions	CPS1	Batch processing	23231	24348
		Split processing	1536	1668
	CPS2		111	159
	CMOV	Batch processing	23018	24175
		Split processing	1548	1685
	CLS	Batch processing	15510	16184
		Split processing	1074	1141
	CLV	Batch processing	15525	16228
		Split processing	1100	1177
	CSCRU		139	167
	CSCRD		129	158
Cursor control instructions	CON1		109	177
	CON2		113	188
	COFF		113	188
	LOCATE	Cursor ON	180	219
		Cursor OFF	62	76

Category	Instruction Name	Condition	Processing Time (μ sec)	
			A3ACPU	A2ACPU
Display condition setting instructions	CNOR		38	49
	CREV		39	50
	CRDSP	1 character	152	188
		96 characters	2027	2219
	CRDSPV	1 character	152	184
		96 characters	2076	2213
	COLOR		47	61
	CCDSP	1 character	162	236
		96 characters	2102	2247
	CCDSPV	1 character	160	197
		96 characters	2051	2247
Designated character display instructions	PRN	1 character	176	216
		96 characters	1140	1234
	PR	1 character	169	208
		96 characters	1240	1371
	PRNV	1 character	178	217
		96 characters	1144	1245

Category	Instruction Name	Condition	Processing Time (μ sec)	
			A3ACPU	A2ACPU
Designated character display instructions	PRV	1 character	172	212
		96 characters	1232	1377
	EPRN	1 character	168	208
		96 characters	1205	1326
	EPR	1 character	162	202
		96 characters	1328	1490
	EPRNV	1 character	168	209
		96 characters	1207	1329
	EPRV	1 character	158	197
		96 characters	1326	1488
	CR1	1 character	113	191
		80 characters	910	981
	CR2	1 character	172	219
		40 characters	956	1041
	CC1	1 character	149	187
		20 character	349	400
	CC2	1 character	168	208
		10 characters	348	398

Category	Instruction Name	Condition	Processing Time (μ sec)	
			A3ACPU	A2ACPU
	CINMP	16 characters	293	333
	CINHP	16 characters	437	490
	CINPT	16 characters	437	490
	CIN0~ CIN9	16 characters	437	490
	CINA~ CINZ	16 characters	437	490
	CINSP	16 characters	437	490
Designated column clear instruction	CINCLR		282	322
ASCII code conversion of display characters	INPUT	1 character	153	192
		16 characters	322	376
VRAM data read/write instructions	GET	1 word	177	221
		96 words	1103	1191
	PUT	1 word	175	219
		96 words	1102	1189
Display state read	STAT		56	72

IMPORTANT

The components on the printed circuit boards will be damaged by static electricity, so avoid handling them directly. If it is necessary to handle them take the following precautions.

(1) Ground human body and work bench.

(2) Do not touch the conductive areas of the printed circuit board and its electrical parts with any non-grounded tools etc.

Under no circumstances will Mitsubishi Electric be liable or responsible for any consequential damage that may arise as a result of the installation or use of this equipment.

All examples and diagrams shown in this manual are intended only as an aid to understanding the text, not to guarantee operation. Mitsubishi Electric will accept no responsibility for actual use of the product based on these illustrative examples.

Owing to the very great variety in possible applications of this equipment, you must satisfy yourself as to its suitability for your specific application.

MITSUBISHI ELECTRIC CORPORATION

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